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Agricultural Journal.

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(Assisted by the Staff of the Agricultural Department).

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VOL. XXIX.] JANUARY, 1932. [No. 1

EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

The Old Year and the New.—The year 1931 has been a very severe one for farmers all over the world, and the adverse economic conditions, combined with local causes, such as foot and mouth disease, have made the farmer's lot in this country a most difficult one. The reduced purchasing power of the people of the Colony has affected the agricultural position to some extent, but only to a very small degree compared with the bad conditions prevailing in overseas markets. The world-wide depression re-acted most seriously on Mashonaland up to the end of March, and the feeling in Matabeleland was not so acute until foot and mouth disease broke out on the Nuanetsi Ranch early in April. This was immediately reported to the adjoining administrations and the movement of all cattle from the infected areas and areas adjacent to them was stopped. Unfortunately it was not cattle alone which suffered under the necessary quarantine restrictions, but the movement of all produce and material

which could possibly carry infection was also prohibited. For some months all trade was at a standstill, and the restrictions on a number of articles still remain.

To 1932 we look forward with hope and confidence. The general world position is not likely to right itself entirely within the space of one year, but there are unmistakable signs that the tide has turned and that the processes of re-adjustment have begun. The position in this Colony has so far improved that we can confidently anticipate the complete disappearance of foot and mouth disease in the near future, and we can hope for a return to more normal conditions before the end of the year. We have numerous illustrations of the wonderful recuperative powers of Southern Rhodesia, and have no doubt whatever that they have not been lost, but are only awaiting a chance to exert themselves.

We take the opportunity of wishing all our readers a happy and prosperous New Year.

New Rainfall Map.—In this issue is a copy of the new Rainfall Map prepared by Mr. N. P. Sellick, the Meteorologist of this Department.

A short explanatory article has been supplied, and, because of the importance of rainfall to the agricultural industry, it is expected that this will be of general interest.

It will be noted that the map is compiled from over 250 stations and reflects the rainfall position of the Colony more accurately than any previous map has done.

As new records become available over a period of not less than ten years, the map will be revised from time to time, but it is not anticipated that this is likely to occur more often than probably once in five or six years.

Wheat Growers' Association.—At a meeting of the Umvuma Farmers' Association held on Friday, the 11th December, 1931, it was unanimously agreed to form a Wheat Growers' Association.

The chair was taken by Lieut.-Col. Guest, and a number of visitors were present, including the Director of Agriculture and the Assistant Secretary to the Rhodesia Agricultural Union.

A very strong local committee was appointed to make the preliminary arrangements for circularising all wheat growers in the Colony in an endeavour to obtain a hundred per cent. representation in the association.

From the discussion which took place, and from the views expressed by representatives from a number of the adjacent wheat-growing areas, it would appear that there is every likelihood of the ambitious programme arranged for the new association being realised.

Moulds as Ferments.—Citric acid is now manufactured in large quantities from cane sugar. A sugar solution is infected with a particular kind of fungus in the same way as yeast is employed as a ferment, but the result in this case is the production of citric acid. It is estimated that about three million dollars' worth of citric acid is produced each year in the United States of America by this process, at about two-thirds the European market price of ordinary citric acid.

A similar process has been developed whereby gluconic acid is produced from glucose by the action of a mould. This has made it possible to produce calcium gluconate at one four-hundredth part of its former cost. Calcium gluconate is the only tasteless salt of calcium known, and has a wonderful advantage over all others owing to the fact that it can be injected into the skin or muscles without causing necrosis of the tissues. This calcium salt also shows promise for the administration of calcium to poultry and cattle.

"Carton Beef": A New Empire Trade?—Experiments on the "quick-freezing" of meat, which may lead to the development of an Empire trade in "carton beef," were described at the Centenary Meeting of the British Association by Dr. T.

Moran, the meat expert at the British Government's Low Temperature Research Station at Cambridge.

Scientists have worked out processes for the quick-freezing of meat which have been so successful that the freezing of small joints of beef in cartons is now a commercial proposition. The joints are wrapped in cellophane and frozen in their cartons, and would go straight from the freezing works overseas to the British housewife without being touched by human hand. They would be retailed, like butter, in sealed packets. Joints which take 80 or 90 minutes to freeze in air can be frozen through in 30 minutes by the new method, in which a brine spray is used. But only joints less than four or five inches thick can be so treated.

"There are still many difficulties to be overcome," Dr. Moran said, "before a trade in 'carton beef' can be developed. But these are commercial and not scientific." The costs are high because inferior joints and offals cannot be exported. Retailers are not yet equipped with refrigerators, and temperatures in cold stores and on railways are not normally low enough for "carton beef," which needs lower temperatures than ordinary refrigerated produce. No one knows, either, what the British housewife will think of the new way of buying her joint. But the possibilities are so great that an effort to tackle the difficulties would be well worth making. The Empire Marketing Board has a small committee which is looking into the position.

Colouring Fruits by the Ethylene Method.—Some twenty years ago it was a common practice to hasten the colouring of fruits by shutting them up in a close room heated by an oil lamp. It was at first thought that the rapid colouring was due to the increased temperature, but it was found that the same effect was obtained from subjecting the fruit to the exhaust fumes of a motor car. About ten years ago it was demonstrated that the real cause of the effect was a chemical compound produced in both cases and known as ethylene. The practical application of this discovery was not possible on any large scale until chemical firms were in a position to supply ethylene gas in large quantities. This

is now available compressed in steel cylinders supplied with a gauge, which makes it an easy matter to liberate a measured amount of gas into an air-tight room, and during the last few years the treatment has been employed for colouring numerous kinds of fruits and vegetables. The great advantage of this process lies in the fact that fruit and vegetables can be picked at such a stage of maturity that they can be shipped with little danger of injury and then prepared for market at a rate approximating more nearly the rate of consumption. Under our conditions, moreover, it has been found that citrus fruits do not colour in keeping with the rate of actual ripening, and therefore lack attractiveness owing to poor colour. To remedy this the Mazoe Citrus Estates have been experimenting with the ethylene colouring process with very satisfactory results. In this case, where the fruit is actually ripe, but lacking in colour owing to climatic conditions, there could be no objection to the colouring process being applied, but the same cannot be said in regard to artificially colouring full-grown but not ripened fruit or vegetables. Investigations were recently carried out by the U.S. Bureau of Chemistry to ascertain what effects, if any, the ethylene process had on the composition of tomatoes coloured in this manner. It was found that the ethylene treatment did not change the vitamin content in any stage, but that tomatoes picked when full grown but still green, if coloured by this process, did not contain nearly so large an amount of vitamins as tomatoes allowed to ripen fully under ordinary conditions.

Tung Oil: a Crop worth trying in Southern Rhodesia.—Tung oil, expressed from the seeds of *Aleurites fordii*, Hemsl., was first introduced into the western world about thirty years ago from China, under the name of Chinese wood oil.

At the present time China exports practically the whole world's supply, amounting to about 70,000 tons, valued at three and a half million pounds. Since no other appreciable supply is known, there exists keen competition for the product, and relatively high prices are maintained, notwithstanding the fact that the quality is often poor.

Tung oil possesses such unique "drying" qualities that it is indispensable in the manufacture of waterproof and non-cracking varnishes, and it is widely used as an ingredient of certain paint media and insulating coatings.

Several species of *Aleurites* are known, *fordii*, *montana*, *moluccana*, *cordata*, and *trisperma*, but the best quality Tung oil is only obtained from *fordii*. These trees belong to the family *Euphorbiaceæ*, characterised by a milky juice, and *Aleurites fordii* is a smooth-stemmed tree reaching 30 to 40 feet in height. The leaves are ovate, three to five inches long, and the flowers are large, two inches or so in diameter, white or reddish white in colour. The fruit is top-shaped, two or three inches in diameter, usually containing five large seeds. The seeds contain a strong purgative and poisonous substance and must not be eaten.

Seeds were introduced into America from China in 1905, and during recent years the Empire Marketing Board has been taking an active part in distributing seeds, with the assistance of Kew, to various parts of the Empire. A large number of trees have been planted in the Union of South Africa, and it is possible that fresh seeds could be obtained from that source in the near future. In this country a few trees have now reached bearing age, and, under certain conditions, appear to do extremely well. It is suggested that this crop is worthy of greater attention, and should be tested out on a small scale at a number of different centres under varying conditions.

The Division of Forestry of this Department has taken considerable interest in the introduction of the Tung oil tree in this country, and has on several occasions distributed seeds free of cost, and a further supply has been ordered. It is anticipated that this will be on sale by about April or May next.

At the present time the Forest Nursery, Salisbury, has some 200 young trees available at 9d. each.

Round Table Conference.—At the last Rhodesia Agricultural Union Congress it was suggested that a round table conference should be called, including the different live stock

industry interests, to discuss the restrictions due to the presence in the Colony of foot and mouth disease. This was held in the Department of Agriculture on the 17th November, and the chair was taken by the Honourable the Minister. Over twenty delegates attended, and the conference was fully representative of both the Matabeleland and the Mashonaland interests.

After the Minister had welcomed the delegates, and indicated the reason for calling the conference, the agenda, which had been prepared by the Rhodesia Agricultural Union, was considered.

Mr. H. G. M. Huntley explained that it had been decided at a private meeting that day to consider the general questions relating to export at a separate meeting, and suggested that foot and mouth restrictions should first be discussed with the Department, and then the cattle owners present should adjourn to discuss certain matters relating to export and to the cattle industry generally. This was agreed to.

Numerous questions were asked in regard to the restrictions which had been imposed, and the question of the desirability of dividing the country into definite zones, which in time of an epidemic could be considered as units for the purposes of restrictions, was discussed.

The Chief Veterinary Surgeon, Mr. J. M. Sinclair, replied to the questions raised, and the Director of Veterinary Research, Mr. Ll. E. W. Bevan, outlined the experiments he had carried out on foot and mouth disease, and indicated that he hoped that the experiments so far completed, and which established a speedy method of transmitting the disease to the entire herd as soon as cases occurred, would be helpful to the Veterinary Department.

The conference adjourned for lunch, and the meeting of cattle owners suggested by Mr. H. G. M. Huntley took place in the afternoon, after which the conference resumed at 4.30 p.m.

Colonel Robins reported that it had been agreed unanimously to form a Cattle Owners' Association representing the Colony as a whole. He stated that a circular letter had been sent out, and that the details of the constitution of this association were being drafted by a small committee.

Numerous points concerning the export of cattle and the possibility of exporting frozen or chilled meat in the future were discussed, and it is confidently anticipated that a number of misunderstandings have in this way been eliminated.

It is felt that this is the first of a series of such conferences which will be of the utmost importance and assistance in establishing a better understanding, and will lead to solutions being found for most of the problems which are at present making the cattle position in the Colony difficult.

Weeds.—All over the world farmers are faced with the most difficult time they have ever encountered, and it is not easy to discover remedies to restore the agricultural industry to a really healthy state again. One thing is certain: New standards will have to be adopted and everything which entails unproductive expenditure discarded.

It would be difficult to imagine a more fruitful cause of unproductive expenditure on a farm than weeds. They rob the soil of plant food and moisture, increase the labour costs, encourage pests of all kinds and crowd out the more useful plant growth.

Weeds are so easily recognised that it seems unnecessary to define the word, but the following definitions may be of interest:—

> All undesirable plants, wherever they may be growing, are weeds.
>
> Any plant that persistently grows where it is not wanted is a weed.
>
> Any injurious, troublesome or unsightly plant that is useless or comparatively useless is a weed.
>
> Any plant whose seeds can retain their vitality when buried in the ground, to appear again when not wanted, is a weed.
>
> Weeds that require more than ordinary care and methods to keep them in check are noxious weeds.

Weeds are often classified according to the period required for them to reach maturity. Thus *annuals* are plants which complete their whole life cycle from seed to seed in

one season. *Biennials* are plants which grow for two years. During the first season most of the energy is devoted to establishing the plant and to root development. The second season flowering stems are produced, and flowers and seeds are formed. *Perennials* are plants which continue to grow for several or many years from the same root system. If allowed to do so, they produce seeds each year just as annuals do. A number of weeds act as *winter annuals* if the seeds germinate in late summer—that is, the young plants remain small during the winter and then complete their growth and produce seeds early in the next summer.

It would appear that a number of well-known weeds, particularly several of the introduced varieties, are increasing and extending their territory rapidly, and that the old saying, "One year's seeding, seven years' weeding," will undoubtedly apply to most of our good soil areas unless steps are taken right away to avoid it. Two Canadian proverbs, "A weed pulled in time means a clean farm" and "Treat your weeds as you would have your neighbour treat his—only do yours first," are deserving of attention. It is of the utmost importance that no weed should be allowed to ripen seeds. Some weeds produce hundreds or even thousands of seeds from a single plant in one season, and the labour required to rid a farm may be increased a hundred-fold in a very few years.

The Noxious Weed Act of 1926 has not been strictly enforced, but it may be necessary to do so unless farmers are sufficiently interested in their own welfare to make this unnecessary.

Buy Rhodesian.—During 1930 some three-quarters of a million pounds worth of live stock and live-stock products, maize and other agricultural products were exported. Under present circumstances the export of practically all farm produce is either restricted or prohibited on account of foot and mouth disease, and there exists a very real and urgent need for the people of Southern Rhodesia to support their own products and industries. Only in this way can the adverse trade balance be relieved.

From six to ten per cent. of the European population of the Colony are farmers or primary producers, and it should be

an easy matter with such a small population to produce the Colony's requirements of such articles as the following, for which the import values for the years 1929 and 1930 are added:—

	1929.	1930.
Wheat	£80,538	£67,382
Flour and meal	28,620	28,927
Potatoes	23,873	12,268
Rice	10,384	9,715
Peas, beans and lentils	6,165	7,177
Barley, malt	8,150	6,884
Oats	2,413	1,844
Coffee (including ground and mixed)	23,672	16,845
Tea	67,653	44,423
Fruit and fruit products	95,657	75,854
Vegetables	12,705	10,121
Pickles, sauces and condiments	9,212	8,161
Plants, bulbs and trees	2,597	2,315
Vegetable, flower and field seeds	4,879	3,418

These figures indicate that actual markets exist in this Colony for agricultural produce greatly in excess of local production at present, and similar figures could be prepared for live-stock produce such as bacon and hams, imported to the extent of nearly twenty-one thousand pounds in 1930. To satisfy these requirements from local sources would demand on the part of the producers:—

That the quality must be up to the average trade standard. Patriotic grounds will not force the consumers of the Colony to purchase inferior products.

That the supplies must be fresh and regular.

That improved co-operative marketing methods must be adopted to ascertain where demands occur and to regulate the supplies to the needs of the various markets.

Under such conditions there would be no excuse for consumers not purchasing the Colony's own products, and we are certain 95 per cent. of the consumers would, in this case, be anxious to use local products.

We would urge the producers, therefore, to give greater attention to the requirements of our own markets and to produce the quantity and quality required. To the consumers we would appeal for greater discrimination in ascertaining the origin of produce offered for sale, and suggest that a little more trouble should be taken to ascertain where regular supplies of local produce can be obtained. In fact, wherever possible, we should buy Rhodesian.

Presentation to Mr. W. E. Meade.—Mr. W. E. Meade, reference to whose retirement from the office of editor of the *Rhodesia Agricultural Journal* was made in our last issue, was the recipient of a farewell presentation from the members of the Department of Agriculture on the morning of the 9th December.

In making the presentation, the Honourable the Minister of Agriculture and Lands referred to Mr. Meade's twenty years' service in the responsible post of editor and to the high standard which the Journal had maintained throughout the period of his editorship. The presentation, which took the form of a suitably inscribed silver cigarette box and a suit case, was eloquent testimony to the affectionate regard in which he was held by his colleagues, and on behalf of the entire staff he wished Mr. and Mrs. Meade every happiness and good luck in the future.

Mr. Meade in returning thanks conveyed his appreciation in particular to the professional officers of the Department for their unfailing support in the form of articles and other contributions. He confessed to having been dubious, when the question was first mooted, of whether so relatively small a staff would be able to provide sufficient material for a Journal published monthly, but events proved his fears to be groundless, and he believed that the monthly issue had maintained just as high a standard as had been attained by the previous bi-monthly issues. It was a great satisfaction to him that, apart from the salary of the editor, the cost entailed in the publication of the Journal was fully covered by the receipts. He appreciated very deeply the kind feelings which had led to the presentation, and, on behalf of himself and Mrs. Meade, he thanked most heartily all those concerned in it.

THE NORMAL RAINFALL OF SOUTHERN RHODESIA.

By N. P. Sellick, M.C., B.Sc., Meteorologist.

The earliest records of rainfall in Southern Rhodesia which are available to-day are those taken by the Rev. Helm at Hope Fountain, near Bulawayo, in 1888. Broken series of records at one or two places are available for the early part of the 1890's, but continuous records may be said to start from 1898.

There are complete records for the year 1898-99 from seven stations well distributed over the country, and this number has increased steadily up to the present date; in 1929-30 complete records were available from 529 stations.

Investigation has shown that at least ten years' records are required to obtain a reasonably close average for any one station. It is customary to correct this average by comparison with a long period station in the neighbourhood; the corrected figure is then called the "Normal."

There are over 250 stations in Southern Rhodesia with complete records covering a period of ten years or more, and the normals of all these have been corrected to the end of 1929-30 and a normal map plotted and included in this copy of the Journal.

An inspection of the map shows that the amount of rain is closely related to the orographic features, the main factors being nearness to the coast and altitude. It also appears that the north is more favoured than the south. The wettest station on our list is Stapleford, the Government Forest Station in Umtali, at an altitude of 5,350 feet, with a normal of 70 inches; and the driest is the township of Beitbridge on the Limpopo, at an altitude of 1,500 feet, with a normal of 11½ inches. The effect of altitude and aspect is very well shown in the Melsetter area, where Brackenbury, at about

6,000 feet, has a normal of 56 inches, and New Year's Gift, only 12 miles away, but in the Sabi Valley, at 2,700 feet, has only 29 inches.

The map shows steps of 5 inches from 10 inches to 40 inches. The number of stations recording over 40 inches is small, and little object would be served by attempting to sub-divide this area.

Twenty-seven per cent. of the country is not at present occupied by persons able to take reliable rainfall measurements; the remainder is divided as follows:—

10 ins. to 15 ins. rain	2 per cent.
15 ins. to 20 ins. rain	3 per cent.
20 ins. to 25 ins. rain	14 per cent.
25 ins. to 30 ins. rain	27 per cent.
30 ins. to 35 ins. rain	21 per cent.
35 ins. to 40 ins. rain	4 per cent.
40 ins. and over	2 per cent.

It appears that approximately half the country enjoys a rainfall of between 25 and 35 inches, and about 20 per cent., mainly in Matabeleland, is under the 25 inch line.

The total annual rainfall conveys a false impression without some reference to the distribution throughout the year. The mean rainfall at Greenwich, for instance, is 23½ inches, and at Bulawayo 24 inches. At Greenwich, however, the monthly means vary from 2½ inches highest and 1½ inches lowest, whereas at Bulawayo the highest is January with nearly 6 inches, and the lowest August with 0.03 inch, averaging a shower once every three years. Further, the evaporation from a free water surface in England is somewhat less than the rainfall, whereas in Bulawayo it approaches 100 inches.

Apart from areas on the eastern border, where winter rains are usual, the whole of the effective rain falls in the period October to April, and in general the October and April rains are small enough to have little effect.

An examination of the monthly means of rainfall shows a steady rise month by month from October to January and a fall from January to April. The actual daily records at Salisbury and Bulawayo have been reduced to a mean over a period of 34 years, and in spite of considerable smoothing,

it appears that the curve is by no means regular. Disregarding minor fluctuations, Bulawayo shows several increases and decreases, and Salisbury has a very marked increase in rain in the last week of November, and a protracted dry period round about Christmas. These fluctuations are very large and apparently real. It appears, therefore, that in the north we have two rainy seasons, one commencing in November and continuing into December; the second commencing in December and ceasing towards the end of March.

SALES.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

Spineless Cactus Slabs (Blades), Algerian Variety: 20 slabs, 5s.; 50 slabs, 10s.; 100 slabs, 17s. 6d.

Stocks are limited, and delivery cannot be undertaken until January next.

Kudzu Vine Crowns: 10 crowns, 5s.; 20 crowns, 7s. 6d.; 50 crowns, 15s.; 100 crowns, 25s.

Delivery during January for dry land. Owing to pressure of other operations, it is not possible to deliver Kudzu crowns during December. The prices are for delivery free at purchaser's nearest station or siding in Southern Rhodesia. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

POISONOUS OR SUSPECTED POISONOUS PLANTS OF SOUTHERN RHODESIA.

TULP POISONING OF CATTLE.

By Sydney M. Stent, Senior Botanist, and D. A. Lawrence, B.V.Sc., Veterinary Research Officer.

Investigation by the Botanist into a case of suspected vegetable poisoning of stock at Marandellas revealed the fact that one of the blue tulps, *Moræa zambesiaca*, Bak. (Govt. Herb., Salisbury, 5226), not hitherto tested for toxicity, occurred in fair quantities along the river bank where the herd had been grazing.

Three sackfuls were collected and sent in to the Veterinary Laboratory, Salisbury, where feeding tests which proved the plant to be highly toxic were carried out.

Description of the Plant.—*Moræa zambesiaca* is one of the blue tulps. The root stock is a corm or bulb up to one inch in diameter, but often smaller, with two or three clustered together forming small clumps. One rather firm, narrow, green leaf is produced from each corm, attaining a breadth of about half an inch and a length of about eighteen inches, often over-topping the flowers. Stem one foot to one and a half feet high, sheathed quite or almost to the base of the flowering head; basal sheaths shorter, closely overlapping and rounded at the tip, more or less straw coloured.

Flowers blue purple, iris like, two or three together, between rather long pointed sheaths (spathes) and developing successively so that there is seldom more than one flower at a time showing from each stem, about two inches

across, with six petals, rather firm and narrowed from the middle to the base into a claw, above the middle broadened into a thin delicate blade—the three outer spreading or more or less reflexed from the middle, the three inner narrower, more or less erect. Anthers, three, closely appressed to the back of the three erect, two-lobed, petal-like stigmas.

Distribution and Time of Flowering, etc.—This species is recorded from several localities in Tanganyika Territory and Portuguese East Africa, but the only records we have of it in Southern Rhodesia are from Salisbury and Marandellas.

The plants were in full flower towards the end of September. The deaths occurred early in the same month.

Moræa zambesiaca is a near relative of *Moræa polystachya*, one of the blue tulps of the Union of South Africa that has been proved to be very highly toxic to animals.

Conditions under which Poisoning occurs.—The fact that animals in feeding experiments are most reluctant to eat the plant indicates that under natural conditions tulp poisoning is only likely to occur when the veld grasses are dry and parched, the green tulp coming into evidence before the new grass shoots. With the other known poisonous species of tulp which occur in the Union of South Africa it has been found that animals reared on tulp veld rarely succumb to poisoning by it, whereas stock recently introduced to such veld are very liable to ingest the plant and die. The explanation appears to be that the native stock when young eat sufficient of the plant to cause symptoms, but recover and are then guided by natural instincts to leave it alone in the future. Hungry animals, whether of native or imported origin, do, however, eat tulp, *e.g.*, when outspanned after a long journey or when settling down to graze after a long trek, especially in an area where the tulp is the only succulent plant present.

Most commonly poisoning only occurs when animals are moved from a non-tulp area to a tulp area.

This species of tulp, and also certain species which occur in the Union, retain their toxicity after drying and there-

fore constitute a very real source of danger when included in veld hay, animals being even more likely to eat them in this form than to graze them in the veld.

Moræa zambesiaca has been proved to be highly toxic to cattle and sheep, and somewhat less so to rabbits, and it is probable that all animals are susceptible. Under natural conditions, however, tulp poisoning may be expected most frequently in cattle, then goats, then sheep, and rarely also in donkeys on account of the methods of grazing of these animals.

Symptoms.—As little as four to five ozs. of green tulp is sufficient to kill a small ox. The symptoms to a large extent depend on the amount of plant eaten, large amounts producing severe symptoms and rapid death within a few hours, and smaller amounts causing symptoms after twelve to twenty-four hours and death within a day or more.

Cattle are first noticed to be restless and breathing heavily, frequently lying down for a few minutes and then again rising and walking around in an uneasy manner. Small amounts of water are frequently drunk, but food is refused. Later, breathing becomes still more distressed, and slight or severe bloating, *i.e.*, upward distension of the left flank, is observed. At this stage the animal appears to be suffering great abdominal pain, frequently kicking at its belly and bringing its head round to the flank. Grinding of the teeth and salivation are also noticed, and diarrhœa commences and may later become blood-stained.

Weakness develops, and finally the animal cannot rise and lies in various unusual positions, blowing heavily and grunting continuously, the expression throughout being very anxious. Death rapidly supervenes, the animal dying while struggling.

When dried tulp is fed in hay the symptoms produced are similar, but colic and diarrhœa are not so marked, and bloating may be absent. Four ounces of dried tulp fed in hay to a two-year-old heifer caused symptoms in twenty-four hours and death within the next twenty-four hours.

The symptoms in sheep are similar, though less distinct, the main symptoms being colic and very distressed breathing.

Post-mortem Findings.—After death bloating progresses rapidly, and the abdomen is found markedly distended. The anus is soiled with moist fæces, and blood may even exude; a few hæmorrhages and severe inflammation of mucous membrane of the anus may be noted. On opening the carcase the blood appears somewhat darker than normal. Blood spots (hæmorrhages) may be encountered on the outer and inner surface of the heart and on the surface of the otherwise normal spleen, occasionally also in the diaphragm. The lungs may appear normal in colour, or rather dark, and on cutting into them a fair amount of froth exudes. The fore-stomachs are distended with gas, if the green plant has been eaten, and the small superficial veins are filled with blood; the contents are rather fluid and slightly gassy; the lining peels off readily even shortly after death, and the surface so exposed is found to be red, and may even show hæmorrhages. The fourth or true stomach is practically empty, and the mucous membrane is somewhat swollen and inflamed, sometimes even hæmorrhagic. The small intestines are more or less empty and inflamed, and show small or large hæmorrhagic spots. The trachea (wind pipe) is either slightly inflamed or else the fine blood vessels are congested.

Treatment and Prevention.—Unfortunately there is no known specific antidote for tulp poisoning, and treatment is carried out with the object of preventing further ingestion of the plant, preventing further absorption of the already ingested plant, counteracting the adverse symptoms and eliminating the poison, absorbed or unabsorbed, from the system. Bearing these points in mind, one realises that any treatment to be effective must be commenced as early as possible, even if symptoms have not yet appeared, but the animal is known to have eaten the plant.

Where possible, a rapidly acting purgative, such as arecoline sub-cutaneously, should be given. If this cannot be effected, it is advisable to give a large dose of Epsom salts, *e.g.*, 1 to 1½ lbs., or raw linseed oil, 1½ to 2 pints, plus 1 to 2 ozs. turpentine if bloating is severe. The beast should not be allowed water for 24 hours. Gruels and milk should be given, and if the animal appears very depressed also a cupful of brandy. Tannic acid (¼ oz.) or copper sulphate (¼ to ½ oz.) may be given in cold gruel or lime water.

Should the animal recover, it should receive succulent and nourishing food and special care for at least a week.

Prevention, as in all other diseases, is better than cure, and can only be effected by keeping the animals away from the areas in which the plant occurs, either by herding or fencing, or by eradicating the plant, either by manual removal or by ploughing, and by ensuring that when cutting hay no tulps are included.

Other Plants Tested.—Several deaths were reported amongst cattle at Shamva, and after it was found that these losses could not be attributed to disease or arsenic, plant poisoning was suspected and an investigation conducted by the Botanist. Two types of plant, *Crotalaria* and *Sphenostylis*, certain close relatives of which are known to be poisonous, and another plant, *Trichodesma*, which was fairly extensively grazed, were suspected, and quantities were submitted to the Veterinary Research Department for feeding tests. These tests failed to prove the plants toxic, but in view of the suspicion attached to them a description is considered advisable.

Trichodesma physalloides, A.D.C.—A low growing, densely leafy shrub with delicate white or blue bell-like flowers that soon turn brown when handled. It occurs plentifully in the spring, especially on burnt veld, the compact clumps with their smooth blue-green foliage and delicate white or blue flowers showing up conspicuously against the blackened ground.

It belongs to the Borage family, which also includes the well-known comfrey, heliotrope, hound's tongue, etc. The family is not considered very harmful as a whole, though certain members of it are said to contain toxic properties.

Sphenostylis marginata, E. Mey.—A low growing, sparsely leafy (in spring) shrubby plant, erect or twining, leaves trifoliate, leaflets oval, very pointed, about 1½ ins. long by ½ in. broad and very shiny. Flowers greenish-yellow, about the size and shape of an ordinary pea flower, usually collected towards the tip of the long flower stalks. Pods long, narrow and flat, spreading horizontally from the stem. This plant belongs to the legume family and occurred in fair quantities over the suspected area. In consideration of

the fact that the legume family contains such a number of well-known stock poisons this plant was regarded with suspicion.

Crotalaria Rogersii, Bak. F.—Low growing shrub with trifoliate leaves; leaflets smooth, ovate, rounded at the tip and narrowing to the base. Flowers yellow, veined with purple-brown, and of more or less the same shape as the pea flower, but rather smaller and with the keel curved and sharply pointed. Pods about 1 inch long and more or less cylindrical. This is one of the "rattle box" plants belonging to the legume family. Several *Crotalarias* have been proved to be highly toxic to stock.

Procedure to adopt in Cases of Suspected Plant Poisoning.—Before attributing losses amongst stock to plant poisoning steps should be taken to determine whether these are not the result of infectious diseases, *e.g.*, anthrax, or mineral or chemical poisoning, *e.g.*, arsenic. When one is reasonably certain that deaths are due to plant poisoning an effort should be made to find out the particular plant responsible, in order to be able to guard against future losses from the same cause. Wherever possible the Botanist will investigate the area for the occurrence in any quantity of possibly poisonous plants, and if such are found two or three sackfuls should be collected and submitted to the Veterinary Laboratory for feeding tests.

In cases of mortality from unknown cause the following steps should therefore be taken:—

1. The symptoms, if observed, and the findings on *post-mortem* examination, which should be carried out in all cases unless there is a suspicion of anthrax, should be recorded.

2. Smears prepared from the blood and from the spleen should be forwarded to the Director of Veterinary Research.

3. A small quantity of the contents of the fourth or true stomach, together with a small portion of its wall, should be submitted to the Chief Chemist for analysis for the presence of arsenic.

4. A larger quantity of the contents of the rumen, or paunch, should be sent to the Senior Botanist. If the results of the smear examination and chemical analysis are negative, such material will then be examined for the presence of any recognisable fragments of poisonous plants.

GWELO MUNICIPAL DEMONSTRATION STATION.

ANNUAL REPORT, 1930-31.

By D. E. McLoughlin, Assistant Agriculturist.

Work has been in progress on this station for eight years, and the valuable information which has accrued therefrom is a tribute to the Gwelo Municipal Council and all those associated with the inception and development of the undertaking.

The experiments are planned on practical lines and serve to demonstrate the behaviour in the Midlands area of the more important crops of the Colony when grown under what are believed to be suitable methods of arable farming.

The red soil station is 10 acres in extent and is divided into 20 half-acre plots. During last season, experiments were carried out on 8 half-acre plots and on 24 quarter-acre plots.

Early rains in November and continuous rain in December provided excellent germination. Seeding commenced on the 25th November, and by the 28th November the planting of all the maize and dolichos bean plots was completed. The season, however, was a very unfavourable one for crop production on account of a rainfall in January which was 3 ins. less than the normal, followed by an almost entire lack of rain in March and April.

The total yield of maize from 5¼ acres was 9,371 lbs. of grain, or 8.9 bags per acre. Ground nuts yielded an average of 17 bags per acre.

The following table gives the distribution of the rainfall for the season and the average for previous years:—

Gwelo Gaol Records.

Month.	Rainfall, 1930-31.	Total No. of rain days.	Greatest fall in one day.	Average for 30 years to 1929-30.
July	.05	1	.05	.02
August	—	—	—	.08
September ...	—	—	—	.17
October	—	—	—	.74
November ...	1.84	8	.84	3.66
December ...	8.07	23	1.71	6.00
January	2.07	10	1.09	5.98
February ...	7.02	8	2.60	5.33
March	.80	3	.70	3.34
April	1.67	6	1.13	.71
May	.23	2	.21	.32
June	—	—	—	.02
Total	21.70	61	2.60	26.37

Gwelo Experiment Station (Sand Veld).

Month.	Rainfall, 1930-31.	Total No. of rain days.	Greatest fall in one day.	Average for 30 years to 1929-30.
July	—	—	—	—
August	—	—	—	—
September ...	—	—	—	.14
October	—	—	—	.51
November ...	1.66	10	.40	3.16
December ...	11.14	19	2.15	7.71
January	1.27	7	.80	4.26
February ...	6.46	9	2.01	4.20
March	.55	3	.50	2.50
April	.80	4	.40	1.32
May	—	—	—	—
June	—	—	—	.03
Total	21.88	52	2.15	23.83

There is no rain gauge at the red soil station, which is about two miles distant from the gaol and the sand veld station.

Red Soil Area.—Two four-course rotations are demonstrated, the land in each during the four years growing two crops of maize, one of ground nuts and one of Sunn hemp (Series "A"), and two crops of maize, one of dolichos beans and one of oats (Series "B").

In Series "A" no animal manure is used, but a green manure crop is ploughed under every fourth year, and the following maize crop receives artificial fertiliser. In 1923-24 and 1924-25 the maize after velvet beans received 150 lbs. complete maize fertiliser per acre, since when the dressing has been amended to 200 lbs. of bone and superphosphate per acre.

Ground nuts receive 200 lbs. of superphosphate per acre; these have been substituted for Sudan grass since 1925-26, the latter crop having previously received the same fertiliser treatment.

In Series "B" seven tons of kraal manure are applied to the maize every fourth year, while the legume crop—dolichos beans—is reaped for grain or fodder and the residue only ploughed in. Thus in these two systems the relative values of kraal manure and green manuring are compared.

The results afford a striking proof of the efficacy of green manuring in Rhodesia, since the average yield of maize in both rotations is virtually the same in number of bags over a period of seven years.

The adjoining control plot, which grows maize continuously without receiving either animal or green manure, demonstrates the rapid fall in fertility which has taken place in the same period on land farmed in this manner.

RED SOIL STATION: ROTATION EXPERIMENTS.

SERIES "A."

Plots of ½ acre each.

Yields of Maize in Bags of 200 lbs. each per acre.

Yields of Ground Nuts in Bags of 75 lbs. each per acre.

Crop.	1930-31.	Average yie'd per acre. 7 years.
Velvet Beans } ploughed **Sunn Hemp* } under.	—	—
Maize.—Receives 200 lbs. per acre bone and superphosphate; after Sunn hemp ploughed under	9.81	13.7
Maize.—Receives no fertiliser; after maize receiving fertiliser	8.36	11.31
Ground Nuts.—Receive 200 lbs. per acre superphosphate; after maize receiving no fertiliser	17.5	(6 years) 18.0

* Commencing 1930-31, Sunn hemp replaced velvet beans as a green manure crop.

SERIES "B."

Yields of Velvet Beans and Dolichos Beans in Bags of 200 lbs. per acre.

Crop.	1930-31.	Average yield per acre. 7 years.
Velvet Beans } reaped.	—	3.14 (5 years)
**Dolichos Beans* } reaped.	4.42	4.42 (1 year)
Maize.—Receives 200 lbs. superphosphate per acre; after beans reaped	11.2	10.96
Maize.—Receives 7-8 tons farm manure per acre; after maize plus fertiliser	11.31	14.78
Oats (*Kherson*).—After maize plus farm manure	Failed	501 lbs. (3 years)

* Commencing 1930-31, dolichos beans replaced velvet beans.

MAIZE CONTINUOUS.

Crop.	1930-31.	Average.
"A"—*Maize continuous.*—Without treatment	5.2	6.56
"B"—*Maize continuous.*—Receives 150 lbs. per acre bone and superphosphate every third year (fertilised, 1930-31)	9.16	9.67

Note.—In 1927-28 fertiliser was applied to plot "A" by error instead of to plot "B," which should have received fertiliser every third year, and which in future will receive fertiliser every alternate year—commencing 1930-31.

The attention of those who question the wisdom of green manuring in areas of light and uncertain rainfall may be drawn to the fact that even in seasons when the precipitation failed to exceed 23.5 inches, namely, five years out of the seven, the maize yield in Series "A," where a leguminous green manure crop is ploughed under once in four years, and a normal dressing of 200 lbs. phosphatic fertiliser is applied twice in four years, has equalled the yield of the maize in Series "B," receiving 7 to 8 tons farm manure and a normal dressing of 200 lbs. phosphatic fertiliser. Over the whole period of seven years green manuring with a legume, combined with two dressings of phosphatic fertiliser, has proved fully as efficacious as a dressing of 7 to 8 tons farm manure and one dressing of phosphatic fertiliser.

The importance of a rotation of crops which will provide an adequate supply of humus in the soil, combined with dressings of phosphatic fertiliser once or twice in the four-year period, and maintain the fertility of the soil at a high level, is very well demonstrated by comparing the yields in both Series "A" and "B" with those of the maize grown continuously without any treatment, and the maize continuous with fertiliser every alternate year.

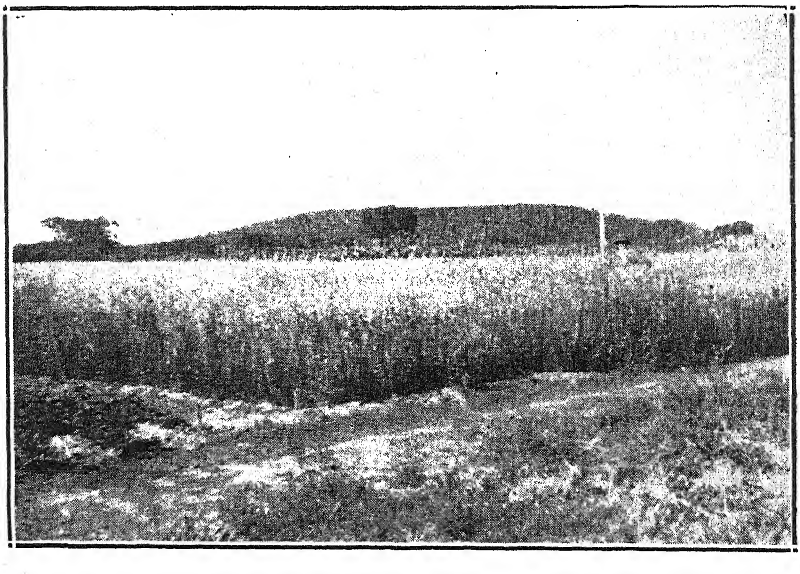
Manurial and Fertiliser Trials.—These experiments were commenced in 1929-30 as the result of analyses of the soil of the station made by the Chemical Division of this Department. Experiments of this kind cannot, however, be carried out here with the same wide range of fertilisers that would be possible on one of the Government stations, and in this case the tests were of necessity designed more as practical than as highly scientific experiments. The work serves to demonstrate the economic value of (a) kraal manure used alone; (b) kraal manure in conjunction with certain artificial fertilisers; and (c) the same artificial fertilisers used without kraal manure.

The manure which was available can best be described as being "loose manure," being that collected from the municipal stockyards, and was, therefore, lacking in the decayed litter associated with true farm manure. The superphosphate used was standard $19\frac{1}{2}\%$ P_2O_5, the muriate of potash 60% K_2O, and the complete maize fertiliser con-

Red Soil Area, Gwelo Municipal Demonstration Station.
In the foreground, velvet beans following oats. In the background, maize plus 200 lbs. bone and superphosphate per acre after velvet beans reaped. 1928-29.

Velvet beans to be ploughed under after ground nuts plus fertiliser, 1928-29.

Red Soil Area. 1928-29.
Maize plus 200 lbs. bone and superphosphate per acre after velvet beans ploughed under.



Sand Veld Area. 1928-29.
Kherson oats in Rotation No. 1.

tained $12\frac{1}{2}\%$ P_2O_5; 3% N; 2% K_2O. The lime was applied to the half of each quarter-acre plot at the rate of one ton per acre.

In order to render the results as comparable as possible, the land selected had previously received similar treatment and grown the same crops, namely, maize for four years without the application of any fertiliser, followed by dolichos and velvet beans for one year without fertiliser. Previous to the first maize crop it was virgin land, having been first broken up in 1923-24.

MAIZE MANURIAL TRIALS.

Plots of $\frac{1}{4}$ acre each, sub-divided into half; one half limed, the other no lime.

Yields of Maize in Bags of 200 *lbs. each per acre.*

Season 1929-30. Fertiliser treatment per acre.	1930-31. Plus 1 ton lime.	1930-31. No lime.	*Average of whole plot for 2 years.
6 tons kraal manure	13.68	12.88	9.73
6 tons kraal manure, plus 250 lbs. superphosphate	11.16	12.04	9.21
6 tons kraal manure, plus 250 lbs. superphosphate, plus 75 lbs. muriate of potash ...	10.64	9.00	8.69
250 lbs. complete maize fertiliser	11.68	10.56	8.93
250 lbs. complete maize fertiliser, plus 75 lbs. muriate of potash ...	9.68	8.72	7.90
250 lbs. superphosphate, plus 75 lbs. muriate of potash	12.04	9.88	10.03

* Unfortunately, in the season 1929-30 the limed and unlimed portions of each plot were not reaped and weighed separately and so for that year only the average yield for the whole of each plot is available. The average for each whole plot is again given for 1930-31 for comparison.

No useful deductions can be drawn from the experiment at the present time and a second three-year cycle must elapse before this can be attempted.

Fertiliser and Green Manure Trials.—This series was introduced to investigate under local conditions the effect of (a) applying phosphatic fertiliser direct to the green manure crop which will be followed by maize, and (b) of applying the same fertiliser dressing to the maize crop following the unfertilised green manure crop of the previous season. Here, raw rock phosphate is applied in both cases at the rate of 200 lbs. per acre.

Method (*a*).—As regards this method, it is claimed by some that in seasons of intermittent and lengthy drought, heavy dressings of fertiliser in the absence of an adequate supply of organic matter and moisture in the soil produce adverse effects on the young maize, causing, after a period of forced growth, a "burning" of the plant, from which it does not readily recover. If the same amount of fertiliser is applied to the previous green manure crop, it increases the bulk of vegetable matter to be ploughed under and the amount of humus thereby added to the soil, and this should aid the moisture-retaining capacity of the soil, affording the crop better opportunity to compete against adverse climatic conditions.

The main objection against this method is the expenditure of money on fertiliser for the green manure crop 20 to 24 months before the following cash crop will be harvested and sold. This money is locked up, and it is, therefore, obvious that the increased returns obtained by this system should be sufficient at least to cover the interest on the expenditure thus incurred.

Factors which must influence the question are the productive power of the land at the time the decision must be taken and the solubility of the phosphatic fertiliser used, particularly in the case of a reputedly slow acting one such as raw rock phosphate.

The following are the results for the first season (1930-31) of the experiment under a precipitation of 21.88 inches:—

Maize, untreated, after Sunn hemp, plus 200 lbs. raw rock phosphate per acre, ploughed under ... ... 8.56 bags per acre

Maize, plus 200 lbs. raw rock phosphate per acre, after Sunn hemp, untreated, ploughed under ... ... 5.26 bags per acre

Ground Nuts.—The highest yield of ground nuts obtained on this station was 23 bags per acre in 1925-26, in Rotation "A," with a rainfall of only 19.53 inches. The average yield to date is 17 bags per acre, and this affords good proof of the suitability of the crop to local conditions of soil and climate. The plant does equally well on sandy soils in good fertility as on the red loam, the best results being obtained when the crop is grown in a rotation with maize or tobacco, and which includes a green crop ploughed under about once in four years. The main problem at present with ground nuts is to obtain a good stand of plants in the field, and this difficulty, coupled with the indifferent attention which is accorded the crop on the average farm, accounts for the deplorably low average yield per acre over the Colony as a whole. To obtain economical returns, even more care perhaps needs to be exercised in planting than with maize. A close spacing of 6 to 8 inches between the plants in the row and as close a spacing between the rows as will permit of machine cultivation is necessary. The seed could also with advantage be passed through a farm-made sieve of the desired mesh to obtain a more uniform sized kernel for sowing. The "brush attachment" specially designed for planting ground nuts and supplied with some makes of planters has proved very satisfactory when correctly adjusted to secure just the required pressure to brush the seed through the holes in the plates. It is better to use a little extra seed than to have to plant an extra acreage to obtain the same yield.

The fact that the Virginia Bunch variety takes longer to mature is often overlooked, and this variety should be planted considerably earlier than Spanish Bunch.

Ground nuts are a valuable stock feed, and the grinding of the whole plant with the nuts attached into a meal is becoming a very general practice.

Yields in Bags of 75 lbs. each, unshelled, per acre.

Treatment.	1930-31.	
Spanish Bunch, in Rotation "A"	17.5	Average yield of 12 plots in 7 years 17.0
Spanish Bunch, with 200 lbs. superphosphate, plus 6 tons kraal manure per acre	16.5	
Virginia Bunch, with 200 lbs. superphosphate, plus 6 tons kraal manure per acre	17.0	

Experience, both on this station and elsewhere, indicates that direct applications of manure and fertiliser to the nut crop are usually unprofitable, and that the most economic results are obtained when the crop is taken as part of a sound rotation system, by means of which the soil is maintained in a good all-round state of fertility.

Legumes for Hay.—The growing of annual summer legumes is of great importance to every farmer, since, apart from their value in providing a hay rich in protein for all classes of stock, they aid very materially in maintaining the soil in good fertility. The more spreading and trailing types serve a dual purpose in checking to some degree surface erosion of the soil. For hay, the heaviest yields are generally obtained from dolichos beans, velvet beans and cowpeas, and for green manuring purposes from the same crops, with, in addition, Sunn hemp.

The marked ability of all four crops to withstand drought renders them particularly valuable for areas of light rainfall. A comparison of Soya bean yields grown with and without the specific Soya bean bacteria is of interest. The treated crop gave a decided increase in yield of grain, and it is hoped that once the necessary bacteria are incorporated in the soils of the Colony, the crop will take first place as a legume hay, its upright growth being of great advantage for mowing.

Yields of Grain in lbs. per acre.

Crop.	1930-31.	Average yield to date.
Dolichos bean (brown, small-seeded)	884	734 (5 years)
Inoculated Soya bean (Otootan) ...	700	700 (1 year)
Not inoculated Soya bean	488	433 (2 years)
White stingless velvet bean	—	661 (5 years)
Tracey's early black velvet bean ...	—	800 (1 year)
Osceola velvet bean	—	660 (1 year)
Sunn hemp	434	411 (2 years)

Wheat and Oats.—In this test, summer wheat for poultry feed and oats were a complete failure owing to drought. Since satisfactory returns from these crops are obtained in parts of the country more favourable for their production, such results may be misleading to farmers in areas of lighter rainfall. These crops can only be relied upon to give satisfactory returns under a fairly liberal rainfall and when grown on fertile soil. Local experience indicates that they are intolerant of drought, and should therefore be grown with reserve until individual farm conditions have been proved suitable to their requirements.

The same remarks apply also to Boer manna. When intended to be grown for hay, both manna and oats are best included in a mixed sowing with Sudan grass. The latter crop, being very drought-resistant, affords an insurance against complete failure.

SAND VELD STATION.

Owing to the poor yields it has recently given, this station was cropped to Sunn hemp with raw rock phosphate during 1930-31. The hemp was ploughed under in March, 1931. The growth was so heavy and the ground so hard, owing to lack of rain in February and March, that the greatest difficulty was experienced in getting the crop turned under. It will be of interest to note next year the yields which this poor sand soil will produce after so thorough a green manuring.

EPHESTIA ELUTELLA, HB., AS AFFECTING THE SOUTHERN RHODESIAN TOBACCO EXPORT TRADE.

By RUPERT W. JACK, F.E.S., Chief Entomologist.

It is now known generally amongst those more immediately concerned that the Pyralid moth, *Ephestia elutella*, Hb., chiefly notorious in the past as a pest of other stored products, has developed into a serious pest of stored tobacco in Britain.

The moth attacks mainly bright and medium leaf, including both Virginia and Turkish, and is considerably more to be feared in Britain than such a pest as the tobacco beetle (*Lasioderma serricorne*, F.), as it has apparently demonstrated its ability to multiply under the climatic conditions obtaining there, whereas the increase of the tobacco beetle appears to be checked to a considerable extent by the low average temperature.

Tobacco manufacturers in Britain take a very serious view of infestation with this insect, and infested bales of tobacco are depreciated in value far beyond the value of the leaf actually destroyed or damaged. Consequently this pest is to be regarded as a menace of the first importance.

The distribution of *Ephestia elutella* is more or less cosmopolitan. It has been recognised as a very bad pest of cacao, cocoa and chocolate. In addition, it is known to attack dried fruit, coffee, walnuts, cotton cake, flour, ships' biscuits, ground nuts, etc. The first record of its attacking tobacco refers to Bulgaria in 1928. Subsequent records referred only to Great Britain, until 1930, when the insect was found to be doing great damage to bright Virginia leaf at Richmond, Virginia, U.S.A. This last discovery occasioned considerable uneasiness amongst tobacco interests in Virginia.

Ephestia elutella has been found in Salisbury, Southern Rhodesia, attacking both chocolate and tobacco. So far, it has not been found anywhere away from Salisbury. Under the "Tobacco Pests Suppression Act, 1931," cleansing measures have been enforced in the exporting warehouses, and, as far as is known, none of these is infested at the present time.

An inspection of the port of Beira by the writer in November, 1929, led to the conclusion that that port was not primarily to blame for infestation of exported tobacco with *Ephestia*. The tranship sheds and surroundings were found to be in a cleanly condition and it appeared that tobacco was not kept in the sheds for any length of time. No possible permanent breeding places could be found.

Cross infestation may, however, well occur at the port if infested consignments are forwarded from Nyasaland, Northern Rhodesia or Southern Rhodesia.* If it can be assured that tobacco and other produce consigned through the port are free from the pest, it is to be inferred that, after a certain period, presuming prolonged storage of tobacco or other produce susceptible to attack is avoided, the port itself will not constitute a menace.

It is probable that the chief danger in any case lies with *tobacco*, because moths resulting from larvæ which have fed on tobacco are probably more likely to lay eggs on tobacco than moths bred from larvæ which have fed on other products. This tendency is a potent factor in reference to the adoption by any insect of a new pabulum. Available evidence suggests that *Ephestia elutella* has only recently taken to feeding on tobacco, indicating that transition from its former foods to tobacco has not been readily effected. A strain of the insect adapted to feeding on tobacco has, however, now obviously been set up at various centres.

It may be added that *Ephestia elutella* has not yet been found feeding on ground nuts, ground nut cake or any produce other than imported chocolate and tobacco in Salisbury.

* To the best of the writer's knowledge *Ephestia elutella* has not been recorded in either Northern Rhodesia or Nyasaland.

In addition to the possibility of cross infestation in the tranship sheds at Beira, the mingling in ships of tobacco from various countries gives ample opportunity of cross infestation occurring *en route* to England.

In reference to this danger, other countries than those exporting through the port of Beira, for example the Union of South Africa, might be involved, either in originating or contracting infestation, but it seems doubtful whether the Union consigns an appreciable amount of tobacco by the east coast route at present.

Whilst it may not be practicable to ensure that tobacco in a clean condition leaving any of the countries involved will not be exposed to danger of infestation on the boat which carries it to England, it appears highly desirable in the first place to ensure as far as possible that it is not exposed to cross infestation at the port, and to endeavour to minimise the risk of cross infestation occurring *en route.*

In this connection it is felt that co-operation between Northern Rhodesia, Nyasaland and Southern Rhodesia would go far to remove the risk of cross infestation at Beira, and that if the Union should ship in the future any appreciable quantity of tobacco by the east coast route, her interests would be identical with those of tobacco exporting countries using the port of Beira. Other east coast ports are, of course, involved, but the amount of tobacco exported through ports other than Beira is at present understood to be very small.

Enforcement of the "Tobacco Pests Suppression Act, 1931," has gone far to ensure that no tobacco exported from Southern Rhodesia will be seriously infested with either *Ephestia elutella* or *Lasioderma*, although, of course, complete freedom from these pests cannot be guaranteed. It is thought that if Northern Rhodesia and Nyasaland would enact similar measures the risk of contamination at Beira or on the voyage to England would be reduced to the minimum, on the assumption that the Union would also take measures to ensure cleanliness of consignments if shipping by the east coast route.

Entomologists in the other countries concerned are likely to be interested in the question of how freedom from the moth is to be assured in the exporting warehouses.

This no doubt depends considerably on local and other conditions, but during the past season in Southern Rhodesia little difficulty has been experienced in ensuring at least approximate freedom. The measures adopted have consisted of enforcing simple cleanliness, that is, elimination of waste tobacco, etc., in which the insect may breed indefinitely. This measure appears likely to suffice in the case of store rooms on farms which contain tobacco during a comparatively short period of the year only. In actual fact, the moth has not yet been found under these conditions.

In central warehouses which may contain tobacco during the greater part of the year the same cleanliness has been enforced and considerable additional protection has probably been secured by the practice of wrapping the bales in tarred paper. "Proctoring" the tobacco is regarded as a fully effective cleansing process in regard to the moth. This is practised chiefly in the big central warehouses. The tobacco is baled and wrapped in tarred paper and hessian coverings immediately it leaves the "Proctor" machine.

Experiments to determine the completeness or otherwise of the protection afforded by tarred paper have been proceeding for a considerable length of time in reference to *Lasioderma*, but the results to date are not fully conclusive. It appears, however, that if the tarred paper is in one piece and the joints are properly sealed, complete protection of uninfested tobacco may be secured against the moth and probably against the beetle, although further experiments are needed for reliable determination of both points.

There seems little doubt that even the wrapping of the bales in the paper, without sealing as in the present practice, has an appreciable protective effect. This has been noted at least in reference to the beetle at Salisbury and should be even more effective against the moth.

It may be mentioned that study of the life history of *Ephestia elutella* at Salisbury indicates that occasional individuals may have very prolonged larval and prepupal stages. The maximum recorded to date is 365 days from hatching to pupation. The actual prepupal, that is, non-feeding larval stage, has in many individuals lasted over the winter months from April to August, but much longer

prepupal periods, extending over 300 days, have been recorded. Development of the insect apparently tends to be resumed as soon as the weather warms up after the winter. These observations need to be extended and duplicated, but it is theoretically possible that actual infestation of a store or warehouse can persist for nearly a year after all sources of food have been removed. This suggests the necessity for thorough cleansing of the walls, etc., of the store or warehouse. At present we are advocating hot lime wash for this purpose, although its action on the resting larvæ has not yet been fully investigated.

In conclusion, it may be pointed out that one of the most important factors in reference to control of all pests of stored tobacco is speedy despatch. It has only been under circumstances of a sluggish market and consequent holding of stocks for several years that pests have come into evidence in this Colony as important factors in the tobacco export trade.

KIRKLEY MISSION TO SOUTHERN RHODESIA.

[The following article is reprinted from the "Meat Trades' Journal and Cattle Salesman's Gazette," dated the 12th November, 1931. It is felt that it will be of interest particularly to the cattle owners of the country.—Ed.]

DEVELOPMENT OF THE CATTLE INDUSTRY IN SOUTHERN RHODESIA.

It is only forty years since Southern Rhodesia was first open to European settlement. During the first decade it suffered from rinderpest, from war, and from rebellion. Rinderpest swept the country from end to end, and as late as thirty years ago Southern Rhodesia imported cattle for industrial purposes and for food consumption. The cattle industry is one which has always shown promise, although it has passed through varying fortunes, and the figures which

I now quote will show that the industry is of considerable importance to the European and native population alike. According to the statistics they were—

	European owned cattle.	Native owned cattle.
1917	532,000	551,000
1920	772,000	744,000
1925	1,006,000	1,095,000
1926	991,000	1,197,000
1927	956,000	1,370,000
1928	905,000	1,420,000

The European is more sensitive to economic conditions than the native, and the lack of markets accounts for the diminution in European owned cattle from 1925 to date.

For the last ten years Southern Rhodesia has been a cattle exporting country, but, due to industrial progress in the Colony and in the surrounding countries, the need for export beyond South Africa has not been keenly felt until more recent years.

Since 1925 there have been small shipments of live cattle sent to the United Kingdom for slaughter, the figures being:

1925.	1926.	1927.	1928.	1929.	1930.
236	310	200	140	695	320

Prior to 1925 the principal outside market for Southern Rhodesian cattle was the Union of South Africa, and the following numbers were exported for consumption in the Union in the years indicated:—

1920.	1921.	1922.	1923.	1924.
21,019	7,313	16,716	32,251	46,407

About that time, the Union of South Africa placed a partial embargo on cattle from Southern Rhodesia, the embargo taking the form of limitation of the entrance of cattle beyond a certain weight. In consequence, it became necessary to look for other markets, and coincident with the partial closing of the Union of South Africa market, a new market opened in the Belgian Congo. The exports from Southern

Rhodesia to the Belgian Congo from 1925 to 1930 were as under:—

1925.	1926.	1927.	1928.	1929.	1930.
4,768	9,016	20,302	26,833	23,956	24,093

In addition, substantial numbers of breeding cattle were sent to the Congo, but their numbers need not be quoted here. Besides the opening up of the Congo market, arrangements were made with a cold storage company to establish itself in Southern Rhodesia and to undertake the purchase of cattle and the export of frozen meat beyond South Africa. The figures quoted below are of the export for the years 1925 to 1930:—

1925.	1926.	1927.	1928.	1929.	1930.
35,675	49,595	16,246	27,123	33,305	21,775

It may be of interest to quote the figures of export to the Union of South Africa market during the same period, the export being confined to live cattle of 1,000 lbs. weight and over:—

1925.	1926.	1927.	1928.	1929.	1930.
9,591	12,250	7,244	10,369	7,214	7,466

I do not want to burden this memorandum too much with figures; I would like to say, however, that since 1920 Southern Rhodesia has exported 540,000 head of cattle, and the following are the exact figures for the years 1925 to 1930:—

1925.	1926.	1927.	1928.	1929.	1930.
60,543	74,821	46,898	71,429	73,615	60,871

The internal markets, i.e., the Union of South Africa, Northern Rhodesia, the Belgian Congo and Portuguese East Africa, are limited markets. The Union of South Africa are themselves large breeders of cattle, and have to seek an outlet outside of South Africa in the same way as ourselves, so that no further expansion can be expected for Southern Rhodesia in that market. The needs of Northern Rhodesia and the Belgian Congo vary with the progress of those countries. Northern Rhodesia is also a cattle-breeding country. There is no reason to expect any substantial increase in the numbers that can be sent north.

The major portion of the frozen meat which has been exported up to date has gone to Italy. The Italian market, to date, has not demanded the highest class of cattle; we can only expect a portion of the market that does exist there, and it is necessary, if there is to be any extension of the live stock industry in Southern Rhodesia, that ways and means should be found of breeding the type of cattle required for the trade in the United Kingdom, of finding means of transporting cattle to port, and of having the necessary facilities for transporting the animals in the form of chilled meat from the port to the United Kingdom, and for the reception and distribution on its arrival there.

Officials in Southern Rhodesia have estimated that the country is capable of carrying eight million to ten million head of cattle and it is reckoned that all the cattle at present in the country could be doubled by natural processes in a period of seven years.

The leaders of the live stock industry in Southern Rhodesia are of opinion that if there is to be any extension of the industry, it is necessary that they should be able to send their live stock to a port within nearer reach of this market than Capetown or Durban, and accordingly the Governments of Bechuanaland, of South-West Africa and Southern Rhodesia, working conjointly, have in the field at the present moment a reconnaissance party investigating the feasibility of building a railway from a point in Southern Rhodesia, through Bechuanaland, joining up with the rail-head in South-West Africa, and thence to the port of Walvis Bay. The possibility of such a line coming within the range of practical politics must depend very largely on the production of increased numbers of cattle in Southern Rhodesia, on the development of live stock as an industry in the Bechuanaland Protectorate, and the finding of markets for the cattle in one form or another in the United Kingdom.

The possibilities of Southern Rhodesia as a breeding ground for the supply of cattle for the provision of meat for consumption in the United Kingdom market have been amply demonstrated by the figures which I have quoted above, and I would like to emphasise the importance of the industry from the point of view of further European settlement in Southern Rhodesia, and from the point of view of increased

prosperity for the native races in that country. It was, no doubt, the recognition of these possibilities which prompted the members of the Kirkley Trade Commission to make the recommendation they did on this subject.

Southern Rhodesia is desirous of finding a market in the United Kingdom for live cattle for slaughter purposes, and for what are known as "store" cattle, as well as for chilled and frozen meat. Given the necessary facilities, it is estimated that breeders now could send 10,000 head of cattle annually to this country of the quality which has been consigned to Birkenhead during recent years.

Southern Rhodesian live cattle suffer a disability on entrance into the United Kingdom market, as compared with some of the large supplying countries, and I understand that legislation would be required before it would be possible for Southern Rhodèsia to send store cattle to this country, in the event of such a project being found practicable. Investigation may show that the freight rates would make the shipment of store cattle unproductive. The rates being paid at present vary from £9 to £10 per head, from Capetown to Birkenhead, plus the cost of feeding and attendance.

The outbreak of foot and mouth disease, which unfortunately made its appearance in the Colony in April last, has resulted in a temporary set-back to this promising industry. Fortunately, the disease is of a particularly mild type; the mortality is low, and it is confidently expected that there will be a resumption of the export of live cattle to the United Kingdom. It is not anticipated, however, that a large meat industry will be built up on the export of live cattle alone, and an investigation is now being made with a view to ascertaining the possibilities of exporting chilled and frozen meat to the United Kingdom.

VEGETABLE GROWING IN SOUTHERN RHODESIA.

ONION CULTURE.

By G. W. Marshall, Horticulturist.

Statistical.—

Onions produced in Southern Rhodesia in 1930	4,582 bags
Onions imported into Southern Rhodesia in 1930	11,964 bags
	16,546 bags
Southern Rhodesia onions exported ...	563 bags
Imported onions re-exported	2,875 bags
Total exports	3,438 bags
Total local consumption	13,108 bags

(All bags weigh 123 lbs. gross.)

We are actually producing only about one-third of our requirements, without allowing anything for export. The value of the imported onions in 1929 was £6,678, and in 1930 £4,919.

The foregoing facts were brought to the writer's notice early in October, with a request that the matter be investigated. The outcome of this investigation, which comprised inspecting onions offered for sale by the principal dealers of Mashonaland and Matabeleland and enquiries put to the owners or managers of the stores visited, has revealed the fact that very few Rhodesian growers appear to be sufficiently acquainted with this crop's cultural requirements, the correct method of harvesting it, or the best way of curing and storing onions.

The general impressions gained during the investigations were:—

(1) That onions of excellent quality may be grown in most districts of Southern Rhodesia, and that some varieties, if properly cured, may be stored for lengthy periods.

(2) That faulty harvesting and storage methods result in the loss of a high percentage of the onion crop that should be available for late marketing, also that very few growers make any attempt to grade their crop.

(3) That some growers still persist in marketing inferior onions and thereby give the local article a bad name.

(4) That a definite glut period occurs from November to January, and a period of scarcity from March to September.

Having given a brief summary of the present position in this respect, an attempt will now be made to deal with the many phases of onion culture in an endeavour to enable Rhodesian growers to supply local requirements throughout the year and also to meet the needs of adjoining territories who may not be in a position to provide their own requirements of onions.

General.—The onion is generally classed as a biennial, although some forms, such as the multipliers, are perennial. Since it is grown for its bulbs, the crop is usually treated as an annual. The bulbs vary in colour, being red, yellow and white, with intermediate shades of these colours. The modern globular onion is of comparatively recent development, having been produced by breeding and selection, and is far removed from the wild species to be found in Southern Europe and in the countries bordering the Mediterranean Sea.

The onion is grown in nearly every country and is universally planted in home gardens. It is extensively used for culinary and other purposes, and may be classed as one of the most important vegetables grown. The crop offers special inducement for the employment of intensive methods, and the profits are usually greater than those derived from other crops.

Climatic and Soil Requirements.—The crop may be grown under a wide range of climatic conditions, but it does best in temperate regions without extremes of heat and cold.

The Bermuda, or flat types of onions, thrive best in this Colony, since temperatures here are somewhat higher than those of the principal onion-growing countries of the world, but it should be possible to grow the globular varieties successfully at the higher elevations of some of the eastern districts.

Dry soil and low atmospheric humidity are necessary for the proper ripening of the bulbs, and also for harvesting and curing. Onions require approximately six months to mature, and it is advisable, as far as onion crop plantings are concerned, to arrange the plantings so as to enable harvesting to be conducted during the dry months of spring (August-October).

The best crops are obtained from soils that are retentive of moisture yet well drained; they should be very well supplied with organic matter, should be friable, easy to work, fertile and free from stones and gravel. The land should be practically level to prevent washing, since most onion plantings in this country will be made under irrigation. Sandy loams, when properly enriched with manure and fertilisers, furnish excellent conditions for the successful cultivation of onions. This class of soil is easily worked and produces solid and heavy bulbs of good keeping quality. Heavier loams will also yield profitable crops when properly handled, but should receive a liberal supply of farm manure to prevent baking, which is most damaging if it occurs when the plants are too small to permit of thorough cultivation. Stiffer soils should be avoided, since they become too hard and compact to yield good results.

Seed Supply and Varieties.—Inferior seed is the source of frequent and heavy loss. Seed should be purchased from a reliable seedsman, and it must be fresh, since old seed results in poor germination and weakly plants. The best seed is produced from selected bulbs which are true to variety and type. Many commercial growers prefer to raise their own seed, and this may be done on most farms. The usual procedure is as follows:—

Select as many superior bulbs as may be required during the harvesting period. These should then be thoroughly dried and stored in a well ventilated room. When the bulbs commence growth they should be planted in well prepared and fertile soil, spacing them 9 inches apart in the rows and allowing 3 feet between the rows. The bulbs should be set fairly deep (3 inches to 6 inches) to enable them later to support their heavy seed heads. Some artificial support may be necessary for the seed heads in windy localities; this may be effected by driving wooden stakes at suitable intervals along the rows, tying binder twine to these supports and tying the heads to the twine on either side.

Seed should be harvested as the heads turn yellow and the seeds black. The seeding stems are detached about 6 inches below the heads and are then tied into bundles and hung in a dry store. The bundles should be covered with cheese cloth or similar material to prevent loss of seed. Later, when thoroughly dry, thrash out and winnow the seed. The cleaned seed should then be thrown into a shallow vessel of water to separate the light seed or rubbish which floats on top and which should be skimmed off and discarded. The heavier seed, which sinks, should then be drained and spread out to dry before storing or planting.

In conducting seed raising experiments at the Grootfontein School of Agriculture, Middelburg, Cape, in 1919, the writer collected the bulbs in October-November and planted them the following June. The seed was harvested early in spring. The varieties under test produced from 600 to 1,900 lbs. of seed per acre.

There are many factors that determine the selection of the variety of onion to be grown. These may be summarised briefly as follows:—Colour, size and shape of bulb, quality, keeping properties, yielding powers, soil and climatic adaptation, time of maturity and purpose for which crop is grown, whether for green, dry or pickling onions.

The Natal Red onion has in the past received most attention; it is one of the Bermuda types and well worthy of the place that it has held. Other varieties, namely, Yellow Bermuda, Early Flat Yellow, Cape Straw, White Queen, Silver King and Silver Skin, have given promising results, but the three latter varieties are more suitable for green

or bunching onions. Silver Skin is particularly suited for producing pickling onions. Danver's Yellow Globe, Australian Brown, Prizetaker, Brown Spanish and various other varieties are also deserving of more attention, but they should first be tested in a small way to ascertain if they are suitable to the climatic and soil conditions under which they are to be grown.

Soil Preparation.—Land that is to be planted to onions must receive thorough preparation, and it should be well ploughed or dug and also disc-harrowed or raked several times to produce a fine and even tilth and a firm planting bed. New land should first be planted with other crops requiring cultivation. Potatoes are excellent for this purpose, since they do best on virgin soil. If coarse unrotted manure is to be used for supplying the necessary humus, it should be applied heavily to the preceding crop to thereby overcome the weed factor which is so troublesome when the manure is applied just before planting the onion crop.

Manuring and Fertilising.—In experimental work conducted in the United States of America, it was ascertained that a fourteen ton crop of onions contained 37.8 lbs. of nitrogen, 12.88 lbs. of phosporic acid and 29.26 lbs. of potash. These figures may have some value in indicating the probable needs of onions grown in this Colony. It will, however, be advisable to add considerably more of the plant food elements than those shown by chemical analysis. No other vegetables require higher fertility, and onions must be provided with a bountiful supply of available plant food until the bulbs are well forward.

Farmyard or kraal manure is better than commercial fertilisers owing to its influence on the physical properties of the soil. Poultry manure is of the greatest value because of its high nitrogen contents.

When manure (of any description) is available, it can well be composited with as much farm or garden refuse in the way of well rotted weeds, old grass, ashes, etc., as are available, and should be applied when the whole has been reduced to a well rotted mass, and most of the weed seeds have been thus destroyed. The compost should then be spread and ploughed or dug in before planting.

The amount of manure to apply depends upon the nature of the soil; 15 to 20 tons per acre is considered sufficient for the average sandy loams of this Colony. When the manure supply is limited, the lands should be sown to a green crop for ploughing in. Sunn hemp is possibly the best crop for this purpose, since it may be sown with the first rains (November) and ploughed in about January, enabling it to rot down before the onion plants are set out in March-April.

In order to raise really payable crops, commercial fertilisers should be used in conjunction with green manures or farm manure, and as a basis to work on it is suggested that 1,000 lbs. of fertilisers containing 4 to 5 per cent. of nitrogen, 8 to 10 per cent. of phosphoric oxide and 8 to 10 per cent. of potash be applied per acre. Soluble nitrogen in the form of sulphate of ammonia or nitrate of soda may also be used with advantage at monthly intervals as a top dressing. Applications should not exceed 50 lbs. per acre; early dressings give best results, and applications should cease at least two months before the anticipated date of harvesting. Onions are gross feeders and are capable of utilising fertilisers when applied at the rate of even two tons per acre, but the applications suggested above should meet requirements in most districts, and prove to be economical.

Sowing the Seed and Transplanting.—In many countries onion seed is sown direct in the field, but this practice is not recommended for Rhodesia, since more even and better sized bulbs may be obtained by transplanting. Furthermore, it costs more to drill, hand thin and seed the *in situ* planted crop, and the additional cost of seed, which amounts to 2 or 3 lbs. per acre, must also be considered. *In situ* planting is only suitable for pickling onions, which are planted thickly to produce small bulbs.

Onion seed soon loses its viability, and growers are consequently recommended to make a small trial sowing in advance of the general seeding and thereby obviate any troubles that may arise from poor germination.

Seed may be sown in any rich and friable garden soil, the beds being well prepared. The usual method is to sow in rows 3 to 4 inches apart, allowing from 10 to 12 seeds per inch of row, and covering the seed with about one half

inch of soil. The seed-beds may be made to any desired dimension, but the 4 by 25 feet size will be found most convenient. After sowing, the beds can be mulched lightly with grass or other suitable material and watered when necessary (usually every evening). The mulch is removed when the seedlings commence to appear, usually about the tenth day; if it is left on too long, the plants will be spindly and more liable to damp off.

With proper care and attention onions should be fit for transplanting in eight to ten weeks after sowing. The transplants are lifted when they are about 9 inches in height and the thickness of a thin lead pencil. The tops are cut off and the roots trimmed back severely, and the plantlets are set from 4 to 6 inches apart in the rows, which should be wide enough to permit of hand weeding and hoeing; 15 inches is an average space between rows. Dibblers are generally used for transplanting, the onions being set at a depth of about 2 inches, after which they are well watered.

The varieties of onions grown from sets and small bulbs from thick sowings may be planted at any season of the year, provided they are about to start growth or the weather is suitable for lifting, dividing and re-planting the multiplying types. The spacing should be the same as that recommended for bulb onions.

Cultivation.—The onion is a shallow-rooted plant, and care must be taken not to injure the roots by deep tillage. Should the soil of the seed-bed become encrusted by heavy rain or faulty watering before germination, remove the mulch and rake lightly. The field encrustation may be rectified by harrowing or raking and then rolling lightly immediately before transplanting or by loosening the soil between the growing crop with a wheel hoe or pronged hoe of the "Norcross" type. Straight rows and uniform spacing are essential for good and thorough cultivation.

Cultivate when the soil is fit after each irrigation or rain. All weeds should be kept down by hoeing and hand pulling, and cultivation should at all times be very thorough, since good crops can only be produced on clean lands.

Irrigation.—Damp vleis if properly handled and drained may be used for growing onions, but they should be of a type

that can be dried out when the crop has bulbed, since onions of good keeping properties may only be produced on such land. With the foregoing exception, onions cannot be grown in Southern Rhodesia without irrigation. If the lands are dry they should be flooded before planting and again afterwards at weekly intervals until the bulbs are well formed; water should then be withheld to induce ripening.

Onions make rapid growth early in the season, and care must be exercised that the crop does not suffer for want of moisture, since crops stinted in this respect seldom bulb satisfactorily.

Rotation.—The onion is one of the few vegetable crops that may be grown successfully for a succession of years on the same land. This is an advantage, since the soil requires to be so well worked and must receive such thorough preparation and treatment. Rotation is only necessary when pests and diseases make their appearance.

Harvesting and Storage.—Faulty harvesting methods are primarily responsible for the failure to adequately supply our own onion requirements. Although the crop is successfully grown in most districts, it is surprising to find so high a percentage marketed in a wet or green condition, little or no attempt having been made to dry, cure or grade the product. Artificial gluts are unfortunately very frequent early in the season. High prices result in the flooding of markets with uncured, damp onions which have no keeping properties.

If the Colony is to supply its own onion requirements and build up an export trade for any surplus, more care will be required in the handling and subsequent storing of the crop.

For the production of good keeping onions, plant varieties known to be good keepers and harvest them when the bulbs are fully developed and the tops are still green. The fields should be gone over at least once a week and all the bulbs lifted that have soft necks; this condition is easily ascertained by the harvester squeezing the neck (portion between the bulb and top) of the onion between the thumb and finger. The harvested onions should then be placed in wind-rows and arranged in such a manner that the green tops of the last bunch adequately cover the bulbs of the preceding

bunch. This is very important, since onions are so easily damaged by sunburn, which also causes the bulbs of white varieties to turn green. If the bulbs are well protected, the onions may be left in the wind-rows for one or two weeks or until they are thoroughly dry. Those that are to be stored should then be plaited into strings—doing this work early in the day when the tops are damp and flexible and making each string about 6 feet in length and 25 lbs. in weight. This is a convenient size and weight to handle. The string onions should then at once be taken carefully and without bruising to the curing shed and hung where they are to remain pending disposal. The strings may be hung over taut wires or laths in such a way that the centre will rest on the support used. If the curing building is high, several tiers of onions may hang one above the other, but care should be taken to ensure sufficient ventilation to prevent heating.

When it is intended to market a portion of the crop from the field, harvest and place in wind-rows as already described. The bulbs should be thoroughly dry, and the tops can then be twisted off at the necks, at the same time rubbing off the dry scales and roots. The bulbs are next graded and placed in sacks of 123 lbs. gross. In grading, all onions that have failed to bulb should be discarded, also those that have thick and hard necks, and particularly any that may have seeded; onions of this type will quickly rot and may ruin the whole contents of the bags.

Early onions should be marketed in crates, since they are liable to serious damage when bagged. Suitable returnable crates holding 50 to 100 lbs. each are now procurable from local sawmills, and any additional cost that may be incurred in purchasing the crates will be offset through obtaining higher prices for the well packed product.

UMVUMA WHEAT EXHIBITION, 1931.

A very successful wheat exhibition was held at the Court House, Umvuma, on Friday, the 11th December, 1931. It was opened by Lieut.-Col. Guest in the absence of the Honourable the Minister, who was unavoidably detained at headquarters by the inter-State conference on foot and mouth disease.

Thirty-five exhibits were shown, of which thirty-two were in the "bag" classes.

Unfortunately, owing to the difficult times farmers are experiencing, no entries were received from the Fort Victoria district, and only one from Enkeldoorn.

The condition in which exhibits were put up showed a marked improvement over last year, but there are still indications that greater care is necessary in preparing grain for the bulk exhibits.

Very valuable prizes were provided by the various firms interested in wheat growing in this Colony, including the Rhodesian Milling & Manufacturing Company, Ltd.; Massey Harris, Ltd.; African Explosives, Ltd.; Messrs. Meikles (Gwelo), Ltd.; Harris Bros., Bulawayo; Fisons' Fertilisers, Ltd.; Anglo-African Trading Company, Ltd.; E. W. Tarry & Co., and a special cup was presented by Lieut.-Col. Guest, M.L.A.

The strongest class was undoubtedly that grown on vlei land without irrigation, and in this the competition was very keen. The special prize in this class was won by Mr. E. G. Raubenheimer, with an excellent bag of Burbank's Quality wheat.

It is interesting to note that the best bag of milling wheat on the show was also grown on wet vlei land. The possibilities of wheat growing in Rhodesia without irrigation were, therefore, well demonstrated at this exhibition, and it is hoped that this and subsequent exhibitions will have a wide effect in stimulating a branch of the agricultural

industry for which considerable scope exists in this Colony. With greater experience in this type of vlei farming, coupled with suitable varieties combining both yield and quality, it is conceivable that this Colony will, in the near future, be in a position to produce most of its own requirements of wheat.

The arrangements for this exhibition were all that could be desired and reflect great credit on Mr. E. T. Palmer, the Native Commissioner of Umvuma, and the members of the committee who assisted him.

MATOPOS SCHOOL OF AGRICULTURE.

The first annual prize-giving and presentation of diplomas took place at the Matopos School of Agriculture on Saturday, the 12th December, 1931. A large number of visitors attended and spent an enjoyable afternoon inspecting the different activities of the school, the live stock, etc.

It was arranged that the Honourable the Minister of Agriculture and Lands should present the prizes. This was unfortunately impossible owing to the inter-State foot and mouth disease conference, which necessitated his remaining at headquarters. The prizes were therefore distributed by Mr. H. G. M. Huntley, the chairman of the Matabeleland Farmers' Association.

Five students received diplomas on the completion of the two years' diploma course at the school. These were Frank T. Eriksson, of Insiza, who obtained honours in animal husbandry and crop production; Rodger K. Cook, of Kingston, England, with honours in animal husbandry; John A. Press, of Cambridge, England; Norman Cook, of Kingston, England; and James D. Paterson, of Edinburgh.

The following six students were granted certificates on the successful completion of the first year's examinations:—Benjamin Barry, Umtali; Jack Green, Marandellas; Alfred Honey, Johannesburg; Norman Leonard, London; Gregory Wilson, Gwelo; Allan Glieman, Northern Rhodesia.

The Director of the Rhodes Matopos Estate, Dr. D. G. Haylett, reviewed the work of the year and indicated the lines along which the future policy of the institution would probably develop. He stated that it was very encouraging to be able to inform the gathering that posts had been obtained with farmers in the country for all the students leaving the institution this year. He expressed the appreciation of the school to the numerous firms who had kindly donated prizes, and to Messrs. Huntley, Brebner and Bett for a shield for the student obtaining the highest number of marks in stock-judging, and to Mr. E. S. White, of Mazoe, for presenting a floating trophy to be competed for annually for maize-growing.

The "Farmers' Weekly" gold medal was won by F. T. Eriksson, the silver medal going to Norman Cook. F. T. Eriksson also won the silver cup presented by Dr. and Mrs. Haylett for the best all-round student of the year, and also the shield for stock-judging.

Mr. G. H. Cooper's prize for poultry went to John A. Press, who also won Mr. White's floating trophy for maize-growing.

It should be noted that from the beginning of next year the school year at the Matopos School of Agriculture will be on a three-term basis, and the following is the school calendar:—

School term begins Monday, 18th January, 1932.

First term ends Thursday, 5th May, 1932.

Second term begins Monday, 23rd May, 1932.

Second term ends Thursday, 18th August, 1932.

Third term begins Monday, 26th September, 1932.

Third term ends Thursday, 15th December, 1932.

ARTIFICIAL SILK OR RAYON.

Artificial silk is the erroneous name given to the products which have been for some time on the market in competition with natural silk. There are several more or less similar products in this class produced in various ways, all similar, however, in one respect, i.e., that they are derived from cellulose. There is no chemical similarity between the so-called artificial silks and natural silk produced by silkworms, and for this reason it is undesirable to retain the common name generally used. The Americans have discarded the name "artificial silk" in favour of "Rayon." Rayon, with the exception of the finest "cuprammonia silk," which has been produced by the "stretch-spinning" process, cannot compare with real silk in fineness nor in strength, but it possesses the lustrous appearance of silk and may be used to advantage woven with real silk without losing the silk-like appearance of the finished product. For this reason it tends to increase the utility of real silk rather than to oust it from the market. Recent figures from the United States of America illustrate this point very definitely, and also indicate the surprising growth of the Rayon industry.

U.S.A.	Real Silk.		Rayon Yarn.	
Year.	Available for use.	Average price per lb.	Available for use.	Average price per lb.
	Lbs.	$	Lbs.	$
1911	29,507,000	3.471	1,143,000	?
1915	36,958,000	3.318	6,818,000	2.0
1920	38,798,000	8.277	12,039,000	4.5
1925	76,003,000	6.341	64,265,000	1.8
1929	96,848,000	4.777	142,384,000	1.1

Cellulose is the only source from which Rayon is produced in quantity, and is likely to remain so. Waste silk, casein, gelatine, egg albumen and agar-agar have been tried, but without success. Cellulose, in its wide botanical sense, is the name given to a group of substances which are elaborated by the living plant cells to provide cell-walls and per-

manent structures. From the Rayon manufacturers' point of view cellulose implies cotton lint or linters and refined wood pulp. To produce Rayon from cellulose, four industrial processes have been developed:—

(a) the Chardonnet or nitro process;
(b) the Cuprammonium process;
(c) the viscose process; and
(d) the acetate process.

In all of these the essential points in the manufacture of the threads are identical. The cellulose is brought into such a condition that it can be dissolved or suspended in a liquid which is forced through very minute holes which imitate the silkworm's spinnerets. As the liquid emerges in a very fine filament it is "set," either by evaporating the liquid contained in the thread or else by coagulating the material by means of a "setting bath." It will be noticed that the former or "dry" method is similar in principle to the spinning process of spiders and caterpillars, and the idea of copying this process was suggested by Robert Hooke in 1664. It is not known, however, that any actual attempt was made to copy this principle until the work of Comte Hiliare de Chardonnet took out a patent for Chardonnet or nitro-silk in 1884-5. Chardonnet, years before, had been a student at the Polytechnic School of Paris under Pasteur during the latter's investigations on silk worm disease, and it is probable that this was the source of the inspiration that started Chardonnet on his life work.

About this time numerous investigations were carried out to discover, if possible, a suitable carbon filament for electric lamps, and the solution of the problem lay in the method adopted in producing Rayon, i.e., reducing cellulose to a state in which it could be squirted through a hole of definite dimensions and carbonising the filament obtained.

The Chardonnet or Nitro-Process.—For the production of nitro-silk, cotton linters have been found to give the best results. The clean, oven-dried cotton is immersed in 40 to 80 times its own weight of a mixture of water, sulphuric acid and nitric acid for about one and a half hours. After nitration is completed, the surplus acid is removed and the nitro-cotton is bleached if necessary, washed and dried. The nitro-

cellulose so obtained is very similar in appearance to ordinary cotton, but it is now soluble in either a mixture of alcohol and ether or in acetone. The former is generally employed, and a 20-30 per cent. solution is used for spinning. Nitro-cellulose, however, is both inflammable and explosive, and it is necessary, therefore, to remove the nitro-groups from the spun filaments, and this is done by soaking in a solution of sodium, ammonium or calcium sulphide.

The Cuprammonia Process.—This process was patented by Depeisses in 1890, and was developed in England, France and Germany with the object of establishing a more economical process than the nitro-cellulose process, chiefly by avoiding the use of alcohol and ether, which are very heavily taxed. It has attained a very special hold on the market owing to the fact that the filament obtained can be subjected to stretching during its gradual coagulation. In this way, even though spinnerets with comparatively large orifices are used, the finest filament can be spun, surpassing natural silk in fineness.

In 1857 E. Schweizer discovered that cellulose would dissolve in the blue solution obtained by dissolving copper hydroxide in ammonia, and the solution became to be known as Schweizer's re-agent, which was specified in the original patent obtained for this process. Latterly, the more usual procedure has been to treat the cellulose—cotton linters in France and bleached wood-pulp in England—first with a mercerising solution of sodium hydroxide and then in a copper sulphate solution, which causes a very intimate incorporation of copper hydroxide in the mass. The surplus copper sulphate solution is then squeezed out, and the mass is immersed in strong ammonia solution in which it dissolves rapidly, to give a high concentration of cellulose.

The Viscose Process.—This is the most generally employed process for the production of Rayon, and it is estimated that it provided a world's output of no less than 235 million pounds in 1927, i.e., 84 per cent. of the total output. Wood-pulp is almost exclusively used for this process, and the bleached cellulose is first treated with a mercerising solution of sodium hydroxide for about two hours. The surplus solution is then squeezed out, and the resultant alkali-

cellulose is torn into crumbs, which are matured for 24 hours more in a closed vessel. Sixty parts of carbon bisulphide to every 100 parts of cellulose are then added, and the cellulose crumbs gradually swell and become deep orange-coloured and gelatinous in three to four hours' time. After the further addition of an appropriate quantity of sodium hydroxide solution and water, a viscous solution is obtained, which is left to ripen until it is in a fit state for spinning. The viscose is filtered and spun by the wet process, i.e., from spinnerets immersed in a "setting" bath of sulphuric acid and sodium sulphate.

The Acetate Process.—This process, utilising cellulose acetate, is not used to any great extent for the production of Rayon, but, owing to the non-inflammable nature of the product, is used more extensively in preparing cinema films, dope for aeroplanes, etc. For the latter purpose a factory costing more than seven million pounds was erected at Spondon, Derbyshire, during the war.

Cellulose acetate is prepared from cotton linters by treating with acetic anhydride, a suitable quantity of glacial acetic acid and about 10 per cent. of sulphuric acid as a catalyst. It is less absorbent of moisture than any of the other so-called "artificial silks" and is an excellent electric insulator.

Uses of Artificial Silks.—The most valuable property of artificial silk is its great lustre, which exceeds that of natural silk and permits of its use for a large number of different articles. Beautiful new effects are obtained by using it as a weft in figured textiles with warp of natural silk, a new opening being thus provided for the latter. It is also used with advantage as weft in silk ribbons. For some years it has held almost undisputed sway in the lace industry. Fringe and cord for ornamental garments, lace, embroidery, etc., are now largely made from artificial silk. Special articles which cannot be obtained with natural silk are made from the artificial product. There is now a large consumption of artificial hair prepared from artificial silk by fusing together several thin fibres so as to form a single large compact filament, which, unlike large fibres obtained directly by spinning, is flexible and resistant.

Another interesting application of artificial silk is in the manufacture of incandescent gas-mantles according to Plaisetty's patent; such mantles are more resistant to shock even after burning, and can be used in trains.

Largely used also is a new product obtained from viscose, namely, a kind of ebonite, which serves well for the manufacture of artistically worked and coloured umbrella handles, knife handles, etc., and resists the action of the acids and alkalis with which it is likely to come into contact.

Casein products, which have also been suggested for these purposes, cannot compete with viscose ebonite, which exhibits marked advantages over bone and horn in the manufacture of brushes, as it can be more easily worked and more easily pierced to allow of the fixing of the bristles.

As hair ornaments for ladies, great use is made of artificial silk in thin sheets or ribbons showing brilliant colours and sparkle. Artificial silk is also used in large quantity for making materials for tapestry, upholstery, neckties, hat-linings, etc.

Viscose has been largely used in recent years to prepare cellophane, which is highly elastic, and its elasticity, tenacity and impermeability are increased by treating it with glycerine. It can be stamped so as to produce artistic effects. Considerable use is made of it as wrapping for meat, cakes, tobacco and cigarettes, sweets, perfumed substances, etc., which are thus protected against water, fatty matters and gases. Cellophane resists alcohol and water even at boiling temperature, and has been proposed as a suitable material for making cinematograph films and for rendering fabrics water-proof.

C. K. B.

FARMING CALENDAR.

January.

BEE-KEEPING.

This month is a slack one for actual hive work. Each hive should continue to be carefully watched to see that any attempt by the wax moth to gain a footing is at once stopped. In the great heat of this month, see that proper ventilation is supplied, as well as enough water. Precautions against the depredations of white and other ants should also be watched daily. Where possible, examine now and again the brood chamber for queen cells, and destroy them if not wanted. Requeening can be done where desired on the uniting system, if the apiarist does not know of the better plan of rearing his own queens. In the workshop have a spare hive or two complete and ready for occupation, well painted, for any new swarms that may be required in the coming months. Though the second honey flow of the season is not due to start until about March or April, there should be ample stores coming in meanwhile to keep all bees busy in breeding, nursing, and bringing the hive generally to full strength for the winter, as well as for their own daily food supplies. There will not be enough honey coming in now for surplus purposes, therefore see that the supers are not left on the hives to a greater degree than to give the inmates plenty of room to loaf in.

CITRUS FRUITS.

The planting of citrus trees should be completed if possible by the end of the month, for trees planted later may not harden up before the winter; they then become susceptible to winter injury from cold. This month is the best one for planting shelter belts to protect all varieties of fruit trees from the prevailing dry winds. Cover or green crops may be planted during this month; if the grove has been over-run with grass or weeds, sow the cover crop seed more thickly. This will assist in smothering future weed growth. Continue suppressing any undesirable shoots that may develop on the tree trunk or other parts of the tree. Drain any depressions that allow rain or irrigation water to accumulate at the base of the trees, for trees permitted to stand in water will speedily fall victims to disease or pest injury.

DECIDUOUS FRUITS.

Continue planting cover or green crops between the trees. These crops may then be turned under towards the end of the rainy season to furnish the necessary humus.

Summer pruning may be continued. Rub or break off any undesirable shoots that have a tendency to crowd each other; suppress all growths on the main stem from the ground level up to the main arms of the tree, for these are unnecessary. If next year's fruit crop is to be of good size and quality, the inner fruiting wood of a tree must receive sufficient air and light to mature fully. If the new growth is too dense it will prevent the fruiting wood from maturing, and poor crops will be the result. The thinning out of the summer growth will overcome this crowding and weakening of the fruiting wood.

Many fruits will be ripening during the month. Do not permit the fruit to become over-ripe on the trees; rather harvest it at the correct stage and store or sell the surplus.

Plant shelter trees if the orchard is exposed to the prevailing winds, as good crops of fruit cannot be expected from inadequately protected fruit trees.

CROPS.

If not already sown, put in the ensilage and fodder crops at once, such as maize and legumes, oats and other hay grass crops. Sow short season crops like haricot beans, linseed, buckwheat, peas, summer oats, gram and mung bean. Plant out grasses and kudzu vine for pasture. Ridge potatoes and cultivate thoroughly. Main crop can still be planted. Quick growing green manuring crops, such as cowpeas, soya beans and sunn hemp, may still be sown this month. Earth up ground nuts so that a small amount of loose soil is thrown over the crowns of the plants. This assists the formation of nuts. If not already done and where practised, legumes or long season oats such as Algerian can be sown under the maize crop for grazing and to add nitrogen and humus to the soil. Cultivate all growing crops well, and thoroughly eradicate weeds. Overhaul all hay-making implements and ploughs and get in thorough repair in preparation for the haying and ploughing seasons. Endeavour to mow grass fields early for hay and litter, and to obtain second cutting for hay in April. Fallowed lands or fields not yet planted may be disc-harrowed or ploughed to prevent weeds from seeding. Mow grass paddocks infested with annual weeds to prevent the weeds seeding. Prevent Mexican marigold and other noxious weeds seeding by hoeing or pulling out the plants by hand. Keep a sharp look-out for maize stalk borer. Cut off the tops of infested plants or treat them with a recognised chemical preparation. If topping is practised, remove tops from land, and bury, burn or feed them at once to farm stock. Watch the maize lands for witch weed. Prevent witch weed plants from seeding by cultivation and by hand-pulling the plants. Make as much manure as possible by placing grass and litter in cattle kraals, pig sties and stables. If there is stumping and clearing to be done, push on with it. Endeavour to get as much of the new virgin land as possible broken up during this and the two following months.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already

been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

ENTOMOLOGICAL.

Maize.—Late planted maize, particularly crops planted after the New Year, are frequently attacked by the maize stalk borer (*B. fusca*, Full.) in districts where this pest is prevalent. The yield of grain from heavily attacked stands is usually very low, and such crops are most economically used as ensilage. Plants attacked are easily detected in the fields, as the newly hatched caterpillars eat the young leaves before entering the stalk. Top dressing with a suitable insecticide should be employed to ensure a good yield. There are several insecticides which can be used for top dressing which kill the young caterpillars without causing severe injury to the plant. Kerol, Kymac or Hycol used at a dilution of 1 in 300, or Pulvex, 1 in 54 gallons of water, give satisfactory results. A new preparation, Derrisol, is highly recommended by the manufacturers at 1 in 1,000, and is stated to be quite innocuous to the plants. The liquid should be poured into the funnel-shaped cup formed by the young leaves. Only those plants showing attack are usually treated. With a light infestation, one native can treat about five acres per day. Several treatments may be necessary. Young maize plants up to six weeks old can be treated by cutting the plant below the point attacked. The portions cut off must be removed from the lands.

Various leaf-eating insects (including the snout beetle (*Tanymecus destructor*), the surface beetles, grasshoppers, etc.) attack young late-planted maize.

The attack by the snout beetle may be very severe. If there is time, it is often advisable to harrow in the old crop, treat the land with poison bait and re-plant, or poison bait may be used without removing the crop. The best carrier for poison bait is chopped Napier fodder or some other green succulent grass, including maize itself; failing this, maize or wheat bran may be used. The carrier is thoroughly covered or impregnated with a solution of arsenite of soda 1 lb., molasses 1½ gallons, or cheapest sugar 8 lbs., water 10 gallons, and broadcast. The cheapest arsenite of soda to employ is locust poison, diluted 1 in 200, and equivalent quantity of sweetening agent added. The best results are obtained if the broadcasting is done in the evening, as the hot sun dries up the bait too quickly and renders it unattractive to the beetles.

Army Worm (*Laphygma exempta*) may put in an appearance during the latter half of December, and a sharp look-out should be kept for the caterpillars, especially on sweet grasses near the maize lands and on "rapoko grass" (*Eleusine indica*) on the lands. (See *Rhodesia Agricultural Journal*, October, 1930, page 1055.)

Black Maize Beetle.—Both larvæ and adults of this beetle are active during this month. Hand collecting of the adults is the only practical procedure. For further control measures, see *Rhodesia Agricultural Journal*, February and April, 1925.

Potatoes.—This crop, if attacked by leaf-eating ladybirds, blister beetles or other leaf-eating insects, may be sprayed with arsenate of lead

(powder), at the rate of 1 lb. in 25 gallons of water. This poison may be combined with Bordeaux Mixture when spraying against early blight. To protect potatoes from potato tuber moth, the rows should be ridged deeply and the tubers kept covered with soil.

Tobacco.—Tobacco in the field is attacked by many insects during this month, and growers should keep a copy of Bulletin No. 665, "Tobacco Pests of Rhodesia," handy for reference, or refer to *Rhodesia Agricultural Journal* for January, 1928. The following very brief account of the more common insect pests attacking this crop may help the grower who cannot consult the above-mentioned bulletin.

Cutworms.—Keep all lands free from weeds up to the time of planting out.

Stem Borer.—All seedlings showing the characteristic swelling should be destroyed by fire. Plants in the field should be destroyed and replaced, or the plant may be cut off below the swelling and one sucker encouraged to grow. The latter procedure needs to be carried out early.

Leaf Miner.—All primings should be destroyed, and infected leaves may be picked off.

Seed Beds.—Seed beds which are no longer required should be cleaned up and not allowed to become a breeding ground to infest the fields. Beds in use should be kept properly covered with limbo and sprayed weekly with arsenate of lead, 1 lb. in 30 gallons of water.

Wire Worms (Trachynotus spp.).—Several species of wire worms attack this crop during January, particularly on sandy soils. It is now too late to attempt control. Control depends upon the accurate timing of the emergence of the adult beetle and poisoning with a poison bait. Emergence usually takes place late in April or in early May. The bait consists of maize meal or bran poisoned with arsenite of soda (locust poison, 1-200). The bait is made up into balls, scattered about the lands. The balls should be covered with leaves, to give attractive shade and to assist in keeping the bait moist. Moisture should be added when necessary.

Surface Beetles (*Zophoses* spp., *Gonocephalum* sp.).—The same control measures apply as for wire worm. Baits recommended against wire worm can be applied during January. No sweetening matter is necessary.

Bud Worm (*Heliothis obsoleta*).—Destroy all caterpillars by hand during "topping." Examine all bagged seed heads weekly and destroy any caterpillars discovered.

Other Leaf-Eating Caterpillars.—A bad attack in the field may be controlled by spraying with arsenate of lead (powder), 1 lb. to 30 gallons of water. A knapsack spray pump with a cyclone nozzle is necessary. Hand picking may be employed.

Beans, Cowpeas, etc.—Haricot beans and cowpeas are liable to attack by the stem maggot (*Agromyza* sp.). This small fly deposits its eggs in the young leaves, often within a few days of germination. The larvæ mine along the veins and down the stem, pupating about soil level. Practically nothing can be done to protect a field crop. Velvet beans, Jack beans and dolichos beans are not attacked by this pest.

All varieties of beans are attacked by a leaf-eating beetle (*Ootheca mutablis*). This small insect can be controlled by spraying with arsenate of lead (powder), 1 oz. to 3 gallons of water.

Blister beetles are often very numerous on the flowers of all species of beans and cowpeas. Hand collecting has been found to be the most economical measure.

The bean stem weevil is a minor pest of beans in the kitchen garden. All plants attacked by this weevil should be picked out and burnt.

Sweet Potatoes.—Sweet potatoes may be attacked by caterpillars of the sweet potato sphinx moth. These should be collected by hand.

Kitchen Garden.—Marrow and cucumber plants about to set fruit may be sprinkled regularly with the following formula to destroy fruit flies which "sting" fruit :—Arsenate of lead (powder), $1\frac{1}{2}$ ozs.; molasses, $\frac{1}{2}$ gallon, or cheapest sugar, $2\frac{1}{2}$ lbs.; water, 4 gallons. To destroy leaf-eating insects generally, dust plants with arsenate of lead (powder), 1 part in 20 parts of finely-ground maize meal or finely-sifted slaked lime. *Aphides* (plant lice) may be treated with soap, 1 lb. in 5 gallons of water, or tobacco wash, or simply by regular spraying with a forceful stream of cold water from a spray pump.

Fruit Trees.—Deciduous fruits are subject to attack by large beetles, which should be destroyed by jarring into a net and dropping thence into a tin containing water, with a film of paraffin on the surface. Trees should be covered in mosquito netting to protect the fruit from fruit-piercing moths. The large adult beetles of the fig borer may be seen on the young shoots and should be destroyed. Borers in the trunks of the trees may be killed by injecting a little carbon bisulphide.

Mosquito, House Flies, etc.—Screen windows and doors. Destroy breeding places around homestead. House flies may be poisoned cheaply with sweetened arsenite of soda solution. Write for directions.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

This month requires all one's energy in the flower garden. Annuals may still be sown for late flowering before the season is over. Planting out should be done as early as the weather permits, and advantage taken of a dull day after a shower for this work. If care be exercised much smaller plants may be put out than would at first be thought advisable, as with attention these will make stronger plants than larger ones, which are more likely to receive a check. The soil requires constant stirring, owing to the packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free of dead and decaying matter.

VEGETABLE GARDEN.

Turnips, carrots, cabbages, lettuce, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on.

FORESTRY.

If the rains are seasonable, plant out evergreen trees, such as gums, cypress, pines, etc. Fill in all blanks as soon as they are noticed, and do not leave them until the following season. Planting should be done on a wet day, or, failing that, on a dull day, or late in the afternoon. Great care should be taken to see that the trees are not planted out any deeper than they stood in the tins.

POULTRY.

All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs.

Foodstuffs must be kept absolutely dry, otherwise they will become mouldy and sour, causing disturbance of the intestinal tract, illness, and perhaps death; certainly a diminution in the number of eggs.

Some of the birds will now be in moult. To get them through it quickly give more sunflower seed, some monkey nuts, plenty of green food, especially cabbage, kale, etc., plenty of milk or some meat, a little sulphur in the dry mash (one teaspoonful to 1 lb.); also stew two dessert spoonfuls of linseed in a pint of water to a jelly, mix this to a crumbly consistency with mealie meal or bran, and give about one dessert spoonful to each bird daily. Keep the birds dry during the rains, otherwise the egg output will decrease.

Do not hatch any more turkeys till after the rainy season is over. Turkeys should not be penned up, but allowed on free range.

Ducks must be treated in almost exactly the reverse manner to what turkeys are. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, mealie meal, meat meal and milk, as much as they will eat three times a day, *i.e.*, they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 p.m., and the first meal is given at sunrise.

STOCK.

Cattle.—The recommendations for December apply equally to this month. Bulls should be returned to the herd during the month if a September or October calving season is desired.

Sheep.—Continue as recommended for December. If heavy rains are experienced a daily ration of a quarter of a pound of maize per ewe will keep them in condition, and will often prevent much trouble arising from poverty and anæmia. Those who favour autumn lambs must put the ram again with the flock in February, and should therefore now take steps (if necessary) by supplying a little extra feed as above recommended to fit the ewes for mating. A little forethought of this kind will tend to increase the stamina of the lambs and to bring the ewes in season more or less together, so that a protracted lambing season is avoided.

TOBACCO.

Cultivation should be systematically continued, and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attacks. All backward plants should be given special attention, and an additional application of fertiliser to hasten growth, so that the plants ripen as uniformly as possible. Curing barns should be placed in proper condition on rainy days, and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform and disease-free plants for producing seed for next season's crop. All plants should be properly primed at the same time that the tobacco is topped.

VETERINARY.

Horse sickness may now be expected, especially in districts where early heavy rains have occurred. Blue tongue in sheep will also be prevalent.

WEATHER.

Heavy rain is to be looked for, and during this month we may normally expect nine to twelve inches on the eastern border, eight in the north, and seven to seven and a half as one travels westwards or southwards. At this time of the year the rainfall tends to be heavier in the eastern than in the western portions of the Colony, whilst prolonged steady rains take the place of the thunder showers which marked the earlier part of the wet season. The growing period is at its height, and high temperatures are registered.

February.

BEE-KEEPING.

In most parts of the two Rhodesias this month is one of fair activity for all bees, there being as a rule quite enough nectar, pollen, etc., available for all ordinary purposes of rearing, building cells, etc., and working generally for the due upkeep of the colony for the present as well as for the coming winter. Whether there will be any surplus honey for them to store will depend upon what crops the farmer may have on hand at this time, as the usual flora of the land will not supply it until the regular second flow of the year is due, which should be in March to April, according to the season.

Watch carefully for robbers, though, with well attended hives and due care in handling, there should be little to fear in this direction; strong, well filled hives can always repel robbers, which are only successful with weak colonies, and these no apiarist should ever have under his care. Mark well last month's advice, i.e., to have everything in readiness for dealing with unexpected new swarms that may be required as they may come, for nothing is more disconcerting or annoying than to be unready when the time arrives. This applies especially to any swarms that may come from the apiary, for a few days only of neglect of such a hive may easily lead to the moth taking early possession of the combs, and in practically a few hours destroy fully drawn-out combs that would otherwise be of much value for after working upon. Such combs, as they are available, should at once be packed away in an air- and moth-tight box or tin for after usage.

CITRUS FRUITS.

Newly-planted citrus trees should be kept free of weed growth likely to exclude necessary air and light for their normal and healthy development. Citrus trees planted in February seldom give satisfactory results; late planted trees do not mature their new growths before winter, and they are more susceptible to winter injury or the ravages of disease or insect pests. The early planted cover crops will be fit to plough under by the end of the month. Do not delay this operation for fear of the rains ending abruptly. If this occurs, great difficulties will be experienced when attempting to plough in the green crops. Keep all young shelter belt trees free of weed growth, and loosen the soil round their stems fairly frequently to eliminate possible ant injury. This is one of the best months for budding citrus trees, either in the nursery or grove—trees that are to be top worked to profitable varieties. Late out-of-season fruit that may have set during December-January should be stripped from the trees. This fruit is valueless for export, and if allowed to mature, will affect the main crop setting of fruit.

DECIDUOUS FRUITS.

When sufficiently mature, plough under cover crops. This should be possible towards the end of the month.

Summer pruning should be completed early in the month; little or no advantage will be derived from trees treated when the new wood reaches maturity.

Do not allow fruit to become over-ripe, then expect remunerative prices for it. If it is harvested at the correct stage, then well graded and neatly packed, good prices may be expected for the surplus fruit sold.

This is a good month for budding deciduous fruit trees.

CROPS.

Cultivate, and keep on cultivating as weather permits, to destroy weeds. Continue to look out for stalk borer, and, if infection is discovered, deal with infested plants as advised in January notes. Watch witch weed and continue cultivating and hand pulling it. Plough under witch weed. smother and trap crops. Where practised, maize can be under-planted with sweet potato vines after the last cultivation for the following season's requirements. Potatoes and ground nuts will probably need to be ridged again. Catch crops of quick maturing beans, such as tepary bean, also buckwheat, can still be sown. Keep down all noxious weeds. This work can be undertaken on wet days. Make veld grass hay whenever a few days of fine weather permit. Early mowings provide the best hay. Seed beds of onions for early winter planting can be sown towards the end of the month. Keep potatoes in a cool shed, well ventilated. Pick over any potatoes in storage and remove bad ones. Continue to make as much farm manure as possible. Begin to ride manure and place in heaps handy to the lands to be manured.

DAIRYING.

This is normally the flush season as far as dairy produce is concerned; dairy cattle are usually in good condition and cows of average capacity should be able to subsist and maintain a full flow of milk on veld grazing alone. Calves may be given a few hours' exercise on bright, sunny days; young stock, however, should not be allowed to run and graze with the herd, and are best kept in a cool, airy pen opening on to a small shady paddock, where they can obtain a little exercise.

A good quality of sweet hay and water should always be available for young calves.

Cream deteriorates very rapidly under the conditions which obtain at this time of the year, so that every precaution should be taken to keep the cream as cool as possible pending despatch to the creamery. As there is a greater strain than usual on the separator during the flush months, frequent oiling is necessary, and care should be taken that the machine is mounted on a level foundation. The separator and all other dairy utensils must be cleaned immediately after use. First rinse the utensils with cool or lukewarm water, then wash thoroughly with boiling hot water, washing soda and a scrubbing brush; scald finally with boiling water.

The cheese in the storeroom is apt to develop mould during wet weather. If the cheese is well made and pressed and has a smooth rind, this mould is merely superficial and will not penetrate into the body of the cheese. Rubbing the cheese with a cloth moistened with a weak solution of formalin or permanganate of potash usually checks the development of mould. During these months care must be taken not to use over-acid milk for cheesemaking, and great care should also be taken of the starter. If this latter shows any signs of gasiness or develops any disagreeable flavour or odour it should be discarded and replaced by a fresh, clean starter. The cheese storeroom must be kept dark and flies excluded.

ENTOMOLOGICAL.

Maize.—The first brood of the stalk borer matures this month, and the young of the second brood may be found amongst the younger leaves. Weeds should be kept down.

Tobacco.—Stem borer, leaf miner and budworms are the chief pests likely to be troublesome. Plants in the field found infested with the first two insects should be heavily pruned or destroyed. The budworm caterpillars can usually be hand picked during the process of topping. (See "Rhodesia Agricultural Journal," December, 1927.)

Potato.—Ladybirds and tuber moth may call for attention. The latter, when very bad, sometimes causes considerable wilting of the crop besides

attacking tubers. The ladybirds may be destroyed by spraying with arsenate of lead 1 lb. to 16 gallons of water.

Cabbage Family.—All members of the family are liable to be attacked by the sawfly and webworm. The sawfly may be effectively controlled by dusting during a dry spell with Paris green and slaked lime (1 lb. Paris green and 20 lbs. slaked lime).

Melon Family.—The most important pest is the melon fly, which "stings" the fruit of all species of gourds. Destroy all badly "stung" fruit and spray remainder thoroughly with arsenate of lead (2 ozs. in 4 gallons of water) to which 2½ lbs. of cheap sugar has been added.

Deciduous Fruit.—Apples, pears and late peaches suffer chiefly from fruit moths, which puncture the fruit. No remedy available except covering the trees with netting.

Fig.—The fruit is liable to the attack of the fig weevil. All infested fruit and all wild fruit should be collected and destroyed. The borer in the stem may be killed by inserting a little carbon bisulphide into the burrow and sealing it up.

Poison Baiting.—Poison baiting against surface beetles, cutworms, etc.: No really effective bait has yet been discovered for cutworms, but the following poisoned bait is recommended for surface beetles, etc.: Paris green 1 lb., 180 lbs. maize meal. Mix thoroughly in dry state and add water until the material is of the consistency of a dough. Roll into small balls and place under shade. Spread in the evening.

FLOWER GARDEN.

Sow carnations, phlox, pansy, verbena, gilias, larkspur, dianthus and pentstemon. The flower garden should be now looking its best, nearly all plants being in bloom. Old and dead flowers should be constantly removed, except when the seed is required. Seeding of the plants shortens their flowering period. All runners and climbers should have constant attention, and be tied up and trained, otherwise they will be damaged by the wind. Dahlias, chrysanthemums and carnations will require staking, as they become top heavy when in flower. Make the first sowing of winter-flowering sweet peas.

VEGETABLE GARDEN.

Sow now—Beans, beet, cabbage, cauliflower, lettuce, peas, onions, carrots, parsnips, turnips, endive, kohl rabi, rhubarb and all herbs.

FORESTRY.

Tree planting operations should be carried out on dull, showery days or late in the afternoons. Take care in setting out the plants, avoid bending the roots, and do not plant deeper than the plants were in the seed beds or trays. Steps should be taken to prepare seed beds for the slower growing species, i.e., pines, cypresses and callitris, and seed of these species should be sown for the following season's planting.

GENERAL.

This is a busy time for the farmer. Weeds will be very much in evidence and difficulty will be experienced in keeping them under. Stock will have fully recovered their condition, but ticks will be troublesome. The dipping tanks must be fully utilised now.

POULTRY.

Cockerels for future breeding should now have been selected, and those not good enough sold for killing. It pays far better to get rid of all of the latter, even if only at 1s. or 1s. 3d. per lb., than to keep them on, eating their heads off, in the hope of getting a better price. Those good enough for breeding, and they must be good, should be kept till about June; there is a demand for such up to this month. Any surplus at this

time should be eaten or sold for what they will fetch. Of those selected for breeding purposes, the owner should keep the best one or two for his own use, with another as a reserve. No poultry keeper should sell his best stock, no matter how high a price is offered for it.

By the end of this month the birds selected for breeding should be mated up. If it is possible, the birds selected for breeding should be given a run on free range for three weeks or so before being put into the breeding pen and fed sparingly; better fertility and better chicks will be the result. If it is possible to run the birds selected for breeding away from the others during the whole of the breeding season, all the better. Any hens that become broody should be kept broody by setting a few china eggs under them until such time as eggs from the breeders come in. Broody hens at this time and for the next five months are valuable.

During the rainy season the scratching litter must be kept dry; if it gets wet it is useless.

Duck hatching can be continued all the year round; the main points are that the young ducks must be kept out of the sun and sleep on dry grass. Nothing is more fatal to ducklings than sun, and dampness at night; and the latter applies, too, to the adults. Unless a dry shed, with a dry, soft layer of chaff or sand, etc., covering the floor of it, is available, it is not wise to hatch turkeys till after the wet season is finished, for it will be labour, food and eggs wasted. If the young turkeys get wet they are almost certain to die. This and the feeding on wet mashes instead of dry food, chopped onions and thick milk are the chief reasons for non-success in the breeding of turkeys.

STOCK.

Cattle.—The recommendations for December apply equally to this month. Be careful that the condition of the bulls is maintained, especially in the case of well-bred animals. A bull in poor condition cannot be expected to sire a large number of calves. As far as practicable cut veld hay during this month. Usually the optimum relation of yield and composition occurs now. During this month, in addition to maize, some protein concentrate such as peanut cake or cotton-cake will generally be necessary in the dairy cow mixture to keep up a good milk flow. Increase the grain ration to bullocks which are being fattened on grass and add some protein concentrate to their feed to make good the deficiency of this nutrient in the grazing.

Sheep.—Continue as recommended for December. If heavy rains are experienced, a daily ration of half a pound of maize per ewe will help to keep them in condition. Those who favour autumn lambs must put the ram again with the flock in February, and should take steps to supply a little extra feed to fit the ewes for mating. Start putting in green feed for ewes due to lamb in April or May.

TOBACCO.

The early tobacco should now be ready for curing. Care should be taken to select only thoroughly ripe leaf for filling the barns, so that the cured product will be uniform. Topping, priming and suckering should be given attention. Selected seed plants should be carefully watched. New land intended for tobacco next year should be ploughed this month, so that all organic matter turned under may be converted into humus before planting time next season.

WEATHER.

This is often the wettest month of the year, with marked differences of from 10 inches to 15 inches on the eastern mountain ranges, 7½ inches over Mashonaland, 4 inches to 6 inches in Matabeleland, and least, but still some, rains in the Limpopo Valley. The rains may be expected to decrease in intensity after the middle of the month if the season is normal.

SOUTHERN RHODESIA WEATHER BUREAU.

NOVEMBER, 1931.

Pressure.—The mean barometric pressure for the month was above normal in the south-west, but below normal in the north.

Pressure Movements.—The equatorial low developed on the 2nd of the month and extended over the Union and Southern Rhodesia up to the 9th and was associated with much rain. No southerly lows appeared during this period. Several weak southerly lows succeeded. The first on the 10th and 11th, the second on the 16th, 17th and 18th, the third on the 20th and 21st, the fourth on the 24th, 25th and 26th. The equatorial low appeared on the 27th and remained in the Cape up to the 29th; on the 30th it extended into Southern Rhodesia and the Transvaal.

Highs showed a characteristic tendency to appear on the south coast and extend along the east coast, anticyclonic isobars only appearing when the high was well in on the east coast.

Two highs appeared, one on the 3rd and one on the 6th, on the south coast; these remained off the coast. A third appeared on the south coast on the 11th and moved inland, covering South Africa up to the 18th. Further highs appeared on the south coast on the 19th and 22nd, and established themselves inland.

Temperature.—Mean temperatures for the month were everywhere well below normal, varying from 2° to 6° F.

Rain.—Scattered showers fell on the 1st, and were fairly general in Matabeleland on the 2nd, extending towards the north on the 3rd and 4th. Showers were fairly general from the 5th to the 13th, lightening on the 14th and 15th, and

were limited to the north-east from the 16th to the 18th. The 19th was fine. Odd showers were reported daily for the rest of the month, except on the 28th, which was fine.

The total amount of rain recorded in the zones was as follows:—

Zone.	November, 1931.	Average, November.
A	5.22	3.0
B	3.33	2.5
C	6.96	3.4
D	3.73	3.7
E	4.60	3.6
F	4.61	5.0

The above table shows that the rain was heaviest in A and C, and below normal in F. The total rainfall for the season is 5.9 inches, as compared with an average of 4.2 inches. Four Novembers are recorded with a higher rainfall, the latest being 1908.

NOVEMBER, 1931.

Station.	Pressure Millibars, 8.30 a.m. Mean.	Pressure Normal.	Temperature in Stevenson Screen °F. Absolute. Max.	Absolute. Min.	Mean. Max.	Mean. Min.	Mean. ½ Max. ½ Min.	Mean. Normal.	Mean. Dry Bulb.	Mean. Wet Bulb.	Rel. Hum. %	Dew Point F.	Cloud Amt. 0-10	Precipitation. Ins.	Precipitation. Normal.	Precipitation. No. of Days.	Altitude (Feet).
Bulawayo ...	868.8	867.8	89.5	53.5	78.2	59.3	68.8	72.6	67.9	61.2	68	57	4.4	4.21	3.2	9	4,436
Gwelo	862.7	...	88	56	77.6	59.4	68.5	73.6	68.5	61.7	68	58	6.6	5.15	3.7	12	4,632
Riverbank ...	...	...	92	57	81.8	61.1	71.5	76.5	70.8	62.8	64	58	...	7.41	2.2	13	4,100
Essexvale ...	...	...	95	55	80.8	60.7	70.8	75.5	68.6	63.4	75	60	..	5.78	2.0	12	3,828
Gwanda ...	910.4	...	94	52	78.9	62.0	70.5	...	70.8	62.9	64	58	5.2	3.07	2.2	7	3,235
Mazunga ...	...	947.6	...	...	...	...	...	78.2	...	...	...	...	...	...	2.1	...	1,970
Nuanetsi ...	...	...	102	58	87.0	63.5	75.3	..	73.4	69.2	81	67	...	3.00	2.9	5	1,630
Between Rivers	...	...	92.7	57.4	82.3	62.2	72.3	...	70.7	63.8	69	60	6.5	9.55	2.4	16	3,970
Enkeldoorn ...	...	...	89	52	76.5	58.6	67.6	72.0	68.0	61.5	69	58	6.5	8.34	3.4	15	4.720
Gatooma ...	...	...	94	57	83.1	61.4	72.3	77.0	71.6	64.3	67	60	6.4	7.62	2.9	16	3,850
Miami	...	...	91	58	80.1	62.8	71.5	...	70.5	64.1	70	61	5.7	6.19	2.3	9	4,090
Salisbury ...	854.9	855.1	87.2	56.1	77.8	59.9	68.9	71.9	68.1	61.2	[illegible]	58	6.5	6.54	3.3	14	4,865
Sinoia, Citrus ...	...	...	...	58	...	61.7	...	...	71.5	66.7	78	64	...	6.59	...	5	3,830
Sipolilo... ...	...	...	92	60	80.3	64.5	72.4	...	72.2	63.6	62	59	5.8	5.79	3.3	12	3,900
Juliasdale ...	...	...	83.7	47.7	72.1	54.3	63.2	64.6	66.1	59.6	68	55	...	3.86	3.6	12	6,070
Mtoko	...	...	91	56	81.1	61.1	71.1	...	71.4	63.7	66	60	5.4	1.02	3.3	6	4,210
Shamva ...	...	...	96	62	84.8	68.7	76.8	...	74.6	...	...	...	6.3	3.94	3.1	8	3,170
Angus Ranch ...	...	...	100	62	82.5	65.7	74.1	79.7	73.0	67.7	76	65	...	2.93	1.8	12	2,300
Craigendoran ...	...	...	97	59	82.7	62.5	72.6	...	74.3	65.8	64	61	...	5.21	3.3	12	3,430
New Year's Gift	...	...	95.2	58.9	80.4	61.9	71.2	...	70.2	65.1	76	62	...	3.29	3.0	11	2,700
Nyamasanga ...	...	...	88	51	77.0	55.4	66.2	...	68.1	60.4	64	55	...	6.54	...	13	5,680
Riverdene North	...	...	92	53	79.6	59.4	69.5	...	68.7	63.5	75	61	...	5.67	2.8	13	3,700
Stapleford ...	...	...	81	46	69.1	54.8	61.9	...	62.4	59.2	83	57	7.6	6.25	6.0	15	5,450
Umtali	893.1	893.0	91	56	77.0	61.1	69.1	72.6	68.6	63.4	75	62	6.5	3.99	3.7	15	3,677
Victoria ...	...	...	90	54	76.8	59.9	68.4	72.7	69.5	63.7	72	60	6.9	2.91	3.0	12	3,570
Melsetter ...	850.9	...	85	52	72.7	56.1	64.4	...	65.3	60.2	74	58	1.8	4.26	5.0	14	5,060
Mount Selinda	...	...	87	52	74.0	59.5	66.8	...	64.3	61.9	87	60	...	6.55	5.0	18	3,520

NOTES FROM THE "GAZETTE."

"Gazette" Date.	Items.
	CATTLE CLEANSING ACT, 1927.
4.12.31.	Government Notice No. 723, "Inspectors under the 'Cattle Cleansing Act, 1927,'" cancels all previous appointments of inspectors and appoints the Chief Veterinary Surgeon, district veterinary surgeons, assistant veterinary surgeons, cattle inspectors and European members of the Police Force who are at present or who may in future be appointed or attested as such to be inspectors for the purposes of the said Act.
	POUNDS AND TRESPASSES ORDINANCE.
11.12.31.	Government Notice No. 734 notifies that, in terms of section 5 of the Pounds and Trespasses Ordinance, a pound has been established on the Government Reserve, Filabusi, Insiza district, as from the 1st January, 1932.

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

GWEBI PRODUCE PRICES.

Hull-less oats	40/- per bag of 150 lbs.
Large Black sunflower seed ...	14/- per bag of 100 lbs.
Dolichos beans	35/- per bag of 200 lbs.
Linseed	60/- per bag of 200 lbs.
Linseed (quantities under 100 lbs.)	4½d. per lb.
Sweet potato tubers (Calabash Leaf)	6/- per bag of 150 lbs.
Napier fodder roots	6/- per bag of 40 lbs.
Sweet potato cuttings (Calabash Leaf)	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.
Pumpkin seed	1/1 per lb.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

DEPARTMENTAL BULLETINS.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 174. Notes on Hop Growing, by H. G. Mundy, F.L.S.
No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.
No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.
No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.
No. 513. The Carob Bean in Rhodesia, by J. A. T. Walters, B.A.
No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
No. 550. Onion Growing under Irrigation, by C. Mainwaring.
No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.
No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.
No. 590. Rye, by H. W. Hilliard, Junior Agriculturist.
No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.
No. 603. The Production of Maize in Southern Rhodesia, by C. Main waring, Agriculturist.
No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
No. 634. Barley, by P. V. Samuels.
No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
No. 656. Tractor Notes, by A. W. V. Crawley, M.E., F.G.S.
No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.
No. 685. Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.
No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.
No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.
No. 700. Further Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.
No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.
No. 708. Witch Weed or Rooibloem (Striga Lutea)—a Serious Menace to Maize, by J. A. T. Walters, B.A., F.R.S.A., Agriculturist.
No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).
No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.
No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.
No. 724. Ploughing by Tractor, by A. W. V. Crawley, M.E., F.G.S.
No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.
No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.
No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.
No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.
No. 759. Witch Weed (Striga Lutea): Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.
No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.
No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.
No. 777. Some Aspects of Cost of Production Studies in Agriculture, by Arthur G. Ruston, D.Sc., Department of Agriculture, Leeds University.
No. 781. Agricultural Costings at the Gwebi Farm—Maize and Green Manuring, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.
No. 783. Agricultural Costings at the Gwebi Farm—Fattening for Beef, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 787. Agricultural Costings at the Gwebi Farm—Ground Nuts and Maize and Beans for Silage, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 793. Agricultural Costings on the Gwebi Farm, by H. G. Mundy, Dip.Agric., Chief Agriculturist.
No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.
No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.
No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.
No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.

No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.
No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.
No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.
No. 833. Subterreanean Clover on the Sand Veld as Feed for Poultry in the Winter, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 836. The Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 837. Veld Grass Silage—A Feature in Rhodesian Pasture Management, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief, Division of Plant Industry.
No. 838. Witch Weed—Progress Report and a Warning, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
Botanical Specimens for Identification.
Accelerating the Sprouting of Potatoes.

REPORTS ON CROP EXPERIMENTS.

No. 94. Second Report on Experiments, by J. H. Hampton.
No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.
No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.
No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
No. 239. Reports on Crop Experiments, Gwebi, 1915-16, Part I., by E. A. Nobbs, Ph.D., B.Sc.
No. 246. Report on Crop Experiments, Gwebi Farm, Season 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
No. 342. Rotation Experiments, 1913-19, by H. G. Mundy, F.L.S., and J. A. T. Walters, B.A.
No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-20.
No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.
No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.
No. 432. Bulawayo Municipal Experiment Station, First Report, by H. G. Mundy, F.L.S.
No. 433. Winter Cereal Experiments, 1921, by D. E. McLoughlin.
No. 437. Annual Report of Crop Experiments, Gwebi Experiment Farm, 1921-22, by H. G. Mundy, F.L.S.
No. 440. Annual Report of Experiments, 1921-22, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
No. 485. Annual Report of Experiments, 1922-23, Agricultural Experiment Station, Salisbury, by J. A. T. Walters, B.A.
No. 486. Bulawayo Experiment Station, Annual Report for Season 1922-23, by H. G. Mundy, F.L.S.
No. 514. Bulawayo Experiment Station Report, 1923-24, by H. G. Mundy, F.L.S.
No. 519. Annual Report of Experiments, 1923-24, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.

No. 537. Crop Rotations on the Gwebi Experiment Farm, 1923-24, by H. G. Mundy, Dip.Agric., F.L.S.

No. 564. A Maize Rotation Experiment, by A. R. Morkel.

No. 566. Bulawayo Experiment Station, Annual Report for Year 1924-25, by H. G. Mundy, Dip.Agric., F.L.S.

No. 608. Annual Report of Experiments, 1924-25, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.

No. 631. Bulawayo Experiment Station: Annual Report for Year 1925-26, by H. W. Hilliard.

No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

No. 675. Bulawayo Experiment Station—Annual Report for Year 1926-27, by D. E. McLoughlin.

No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.

No. 688. Report, 1923-24—1926-27, Gwelo Municipal Demonstration Stations, by D. E. McLoughlin.

No. 716. Report, 1927-28, Gwelo Municipality Demonstration Stations, by S. D. Timson, M.C., Dip.Agric.

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Abnormalities in Eggs, by A. Little, Poultry Expert.

METEOROLOGICAL.

MISCELLANEOUS.

THE RHODESIA

Agricultural Journal.

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(Assisted by the Staff of the Agricultural Department).

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EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Matopos School of Agriculture.—Owing to structural alterations which are necessary to provide accommodation for the agricultural students in view of the establishment of a preparatory school, under the Department of Education, at Matopos, it has been decided that the first term this year will commence on Monday, 1st February, 1932, instead of 18th January, as previously arranged.

Full particulars regarding courses, fees, etc., may be obtained from the Director.

Soil Erosion.—Owing to the reduction of staff, the Irrigation Division urges that farmers requiring advice on soil erosion should send in their names as early as possible in order that tours may be efficiently arranged. This applies particularly to farmers who wish to obtain advice on levels

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for contour ridges during March or April, when green manure crops have been ploughed in. Not only is the excavation more cheaply done when the ground is soft, but a more even distribution of the work over the season is obtained, thereby assisting both the farmers and the engineer.

Rotary Cultivation.—Mechanical power applied to agriculture has brought into being new possibilities in soil cultivation. This is illustrated by the recent development of so-called rotary cultivation, which was predicted more than sixty years ago by Hoskyns, and is now an accomplished fact and is being tested at Rothamsted Experiment Station. The main idea is that the rotary motion of an engine need no longer be converted into a straight pull, but can be communicated direct to a rotating shaft carrying tines. In this way the movement which loosens the soil also helps the machine forward. It would appear from tests already completed that the physical conditions of the soil worked with a rotary cultivator are different from those produced where the ordinary methods of ploughing and harrowing have been employed, but it will be necessary to test these effects on a large variety of soils before any definite statement can be made.

Milk Recording Scheme.—A system of milk recording has been in force in this Colony for the past three years, and it is gratifying to note that the service has become very popular with dairy farmers both for pedigree herds and for grade dairy herds. It has been decided to maintain the two recorders and to extend the service as far as it is practicable without any additional increase in staff. To make this possible it has been found necessary to reorganise the semi-official recording scheme, that is the scheme dealing with grade cows, on a bi-monthly basis.

The regulations governing the milk recording of both pedigree and grade dairy herds are published in this issue.

It is essential that the official scheme should be dealt with by the recorder monthly and that the service should be looked upon as a permanent one. In the case of grade

herds, however, it may be necessary to withdraw the services of the recorder after two or three years, when the farmers concerned will have to carry on the recording themselves, so as to enable new herds to be brought within the scheme.

High Speed Gas Producer.—A cheap form of power for farm use is one of the most urgent requirements of most African territories, including Southern Rhodesia. Where tsetse fly exists the demand is even more pressing, and it is essential that the power must be adaptable to tractors and lorries for farming operations and transport where it is impossible to maintain oxen.

The Department of Agriculture has been watching the attempts to supply a cheap form of power for agricultural purposes for many years, and has investigated every case where definite progress has been claimed. During the last five years several demonstrations have been arranged, but in every case the results have been more or less disappointing. The latest developments with the plant designed and patented by Major J. A. Macdonald, of Kenya Colony, appear to be far ahead of anything which has yet been tried, and we welcome the opportunity which was given to Mr. B. G. Gundry, of the Irrigation Engineer's staff, to investigate the working and general performance of the plant. The report is published in this issue and will undoubtedly be of general interest.

The Raising of Bacon Pigs.—For the last few years the number of European-owned pigs in this country has only increased to a very small extent. This position is undoubtedly due to the limited character of the local markets and the absence of export facilities. In the Union of South Africa the number of European-owned pigs has actually decreased during the last five years, probably for similar reasons.

Attempts to export bacon and pork have so far not been a financial success, but the results of small consignments have indicated that South Africa can produce bacon of the quality required by the English market, but it is undoubtedly true that the consignments which were so well commented

on in London were specially selected and not of the usual type produced.

If any large increase is to be possible it will only be in view of an export market, and before this can be done the type of bacon pig throughout the Colony must be improved.

The first part of an article indicating the requirements and the lines on which the desired results may be obtained appears in this number of the Journal, and will be concluded by a second section in the next issue.

This should be of particular interest to farmers throughout the Colony, and any further information which may be desired on the subject may be obtained from the Senior Animal Husbandry Officer of the Department.

Tobacco to Control Round-worm in Poultry.—Adding tobacco to the rations fed to poultry to prevent round-worm trouble has been tried experimentally at the Pennsylvania Experiment Station for the past two years.

During 1930 two hundred day-old chicks were divided into five groups and placed in battery brooders. Group I. served as a control and received no tobacco. The remaining four groups received tobacco in the mash as follows:—

Group II., 0.2 per cent.;
Group III., 0.4 per cent.;
Group IV., 0.8 per cent.; and
Group V., 1.2 per cent.

These figures are based on a tobacco dust analysing 5 per cent. nicotine. During the first few weeks of their lives each bird received approximately 15,000 round-worm eggs. These eggs were incubated and administered just before the worms were ready to hatch. The birds were killed and post-mortem studies were made about 10 weeks after infestation. Seventy-eight per cent. of the birds in Group I. (the control) were infested. Five per cent. of the birds in Group II. were infested, but no infestation could be observed in Groups III., IV. and V. This work is still in the experimental stage, and no recommendations regarding the practical use of this type of product can be made at the present time.

An Experiment on the Transport of Chilled Meat.—During December an interesting experiment was carried out to determine the possibility of chilling and transporting meat with the facilities at present available in the Colony.

The preliminary organisation of the trial was undertaken by Major Gordon with the purpose of demonstrating the practicability of shipping chilled meat from Bulawayo to the United Kingdom. Major Gordon was able to collect sufficient funds from interested farmers to purchase 18 bullocks, to which number a further 2 were donated by the Matopos School of Agriculture, making a total of 20 head.

The cattle were slaughtered at the Rhodesia Export and Cold Storage Co., Ltd. The carcases were then chilled, placed in one of the new type refrigerator trucks and shipped over the Rhodesia Railways to Umtali and back to Bulawayo. The return journey took 3½ days. Half the carcases were then returned to the Cold Storage and the remainder left in the truck. Both lots were then maintained at chilling temperature (28-30 degrees F.) for 25 days. The combined period of 28 days is well over the time within which (21-22 days) it is possible now to ship chilled beef from Bulawayo to the United Kingdom.

Close records as to the temperature and keeping qualities of the meat were made at frequent intervals by officials of this Department. At the end of the 28-day period all the carcases were inspected and reported on by the heads of two Bulawayo butcheries and by members of this Department. Some of the meat was then distributed to hotels and private individuals in and around Bulawayo for cooking trials and report.

The reports in regard to the keeping and cooking qualities of the meat were very satisfactory as judged from local standards. It is probable, however, that considerable improvement would have been required in the case of some sides to meet Smithfield requirements. The meat, however, had a severe trial. Owing to minor practical difficulties, which should be easily overcome in the future, the temperature variations were too large to produce the best results. Under the circumstances, however, the results can be considered very satisfactory, and show that, with proper

precautions, there should be little technical difficulty in shipping chilled meat to England.

It should be mentioned that the Rhodesia Export and Cold Storage Company and the Rhodesia Railways carried out their share of the experiment free of cost.

What are the Fertiliser Requirements?—It is usual in present day fertiliser catalogues to indicate composition under three main headings:—

(a) phosphoric oxide;
(b) nitrogen; and
(c) potash.

In addition to these, agricultural lime is usually quoted as being necessary to correct soil acidity, to improve the physical condition and to release other plant foods from the reserve supply in the soil. This reflects the correct view that these are the most important plant foods required, and that as a rule the soils, fertilisers and farm-yard manure supply sufficient of the other mineral elements for the profitable production of crops.

If asked what other elements were essential, the reply, until recently, would have been magnesium, sulphur, carbon, hydrogen, oxygen, iron, chlorine and silicon. Recent researches, however, have indicated that some of the less common elements prove to be of the greatest importance in the nutrition and growth of both animals and plants. On certain types of soils, for instance, it has been definitely shown that the absence of manganese accounted for a diseased condition of plants which could not be corrected by ordinary fertiliser treatment, but which was entirely overcome by the application of small doses of manganese sulphate to the acre. Experiments with copper, zinc, barium and boron in very small amounts have indicated that remarkable plant response may be obtained from their use on varying types of soils. Copper is perhaps the most striking. It would appear to be the case, although not conclusively proved as yet, that a physiological disease of citrus trees known as "die-back" may be remedied by the application of

a very light dressing of copper sulphate. This is an interesting fact, and the remarkable stimulative effects upon the soil obtained by spraying plants growing in certain soils with Bordeaux mixture—a mixture of copper sulphate and lime—are often attributed to the effect of the copper. The credit, however, as far as the soil is concerned, should, we think, be given mostly to the lime.

Boron, in very minute quantities, is essential for plant development and for the production of fruit. One investigator, working with broad beans, found that best results were obtained with quantities of approximately one part of boric acid per million of the culture solution. This illustrates a fact which is extremely important in applying all the more unusual elements. Very minute quantities are essential, but any excess over the essential amount may be harmful and cause complete crop failure.

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

THE RAISING OF BACON PIGS.

By A. E. Romyn, Senior Animal Husbandry Officer; and C. A. Murray, Lecturer in Animal Husbandry, Matopo School of Agriculture;

With a Veterinary Section by D. A. Lawrence, Veterinary Research Officer.

Introduction.—It seems necessary these days to preface any article on pigs with a statement as to the economic position of the industry.

The pig industry in South Africa has not grown during the last few years. This lack of progress is due chiefly to the relatively poor quality of most of the pigs produced and to the limited character of the local market, which, in the absence of an organised export trade, is easily over-supplied. Periods of over-supply have occurred at regular intervals during the last decade, and the resultant low prices at each of these periods have discouraged production and prevented permanent growth in the industry. The relative stagnation in numbers is plain from the following figures:—

NUMBER OF EUROPEAN-OWNED PIGS IN THE UNION OF SOUTH AFRICA AND SOUTHERN RHODESIA.

Year.	Union of South Africa.	Southern Rhodesia.
1925	528,085	20,156
1926	613,520	20,385
1927	569,447	19,981
1928	550,521	21,102
1929	513,439	23,490
1930	—	25,536

Attempts to export bacon and pork to relieve the situation have so far not been a financial success. Isolated small consignments of bacon have been well commented on in England, and prizes have been won at the London Dairy

Show. While these results indicate that South Africa can produce bacon of the quality desired, the low grade of most of the bacon produced here and its relatively high cost of production have prevented the trade from going ahead.

South Africa is well suited to the raising of pigs, and records of the industry show that during the last decade the consistent pig farmer has made profits from pig keeping which compare favourably with other agricultural enterprises. There is no reason why this type of farmer should not continue to make similar profits in the future.

It is now generally realised that there will not be a stable local market for pigs until an export trade is developed. Recent developments in the transport of mild-cured bacon and the improvement in the quality of the pigs, which has occurred during the last few years, make the prospects for such a trade much more hopeful than they have been. In this connection the efforts now being made in the Union to organise the pig industry and develop an export trade should be closely watched by farmers in this Colony.

There are difficulties ahead, but the materials are available to build up a relatively important industry. The success of the enterprise will, however, depend upon the ability of producers to meet the requirements of the English market and on their success in reducing production costs. The efficient producer should be able to do both.

THE BACONER.

The Type of Pig Required.—Certain parts of a bacon side are more in demand and have a higher value than other parts.

The relative wholesale prices for the different parts of the bacon side are shown in Figure I. It will be noted that the valuable parts are the middle and the hams. The fore end is of much less value.

The desired type of pig is one which has the maximum development in the valuable parts, and pigs of the desired quality and conformation are either known as "select" or "prime" baconers. They have the following characteristics:

(a) **Conformation.**—*Great length* between the shoulder and ham. The back should be slightly arched and be of

medium and uniform width from rump to shoulder. The sides should not be too deep, but of *uniform depth* from chest to flank. The shoulder should be as *light* and *fine* as possible, showing no signs of coarseness and blending *smoothly* with the sides. The *finer* and *lighter* the jowl and neck the better, as these parts have relatively little value. The hams, being the highest priced part of the carcase, should be *well developed, broad, plump* and *well let down* to the hocks. The underline should be *firm, full* and show *no* signs of flabbiness.

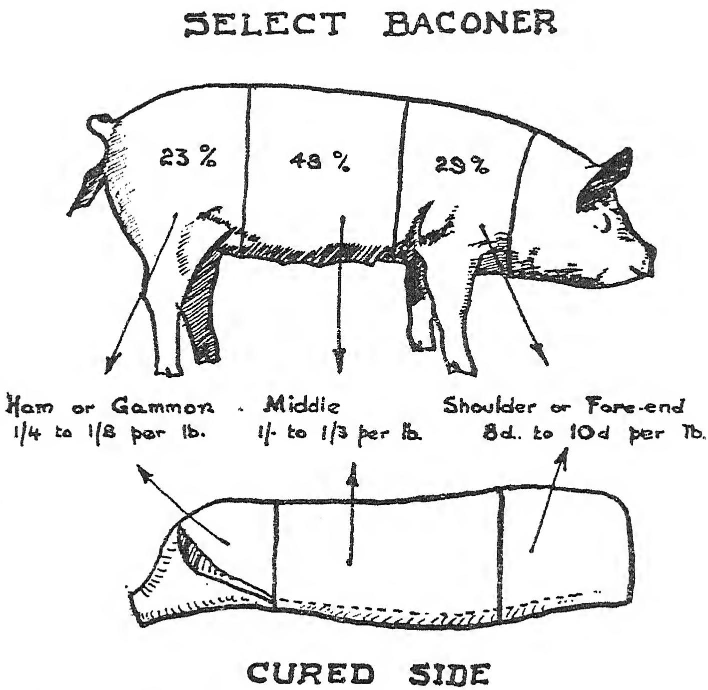


Fig. I. Relative wholesale values for different parts of the side.

A baconer should give one the impression of a long, lean, well-fleshed pig showing no excessive tendency to lay on fat. The short, broad, deep, lard type of pig should be avoided altogether. Figure II. illustrates the correct type.

(b) **Quality.**—It is of importance that the baconer should show *quality* and *thriftiness*. A *thin, smooth* skin and *fine* covering of hair indicate these. Any sign of

coarseness, such as is found in a heavy shoulder, wrinkled skin and rough hair, is most undesirable.

(c) **Finish.**—When marketed the baconer should be *well finished,* i.e., the back, sides and underline should be well filled and have a *smooth* and *full appearance.* The back fat of an unfinished pig is generally too thin and soft, and the whole carcase has a flabby appearance. The over-finished pig, on the other hand, is too fat for the production of the best quality bacon.

(d) **Correct Weight.**—The weight at which to market a bacon pig depends on the type of pig. The longer the pig, the heavier is the weight to which it has to be fed to secure a proper finish. The shorter the pig, the lighter is the

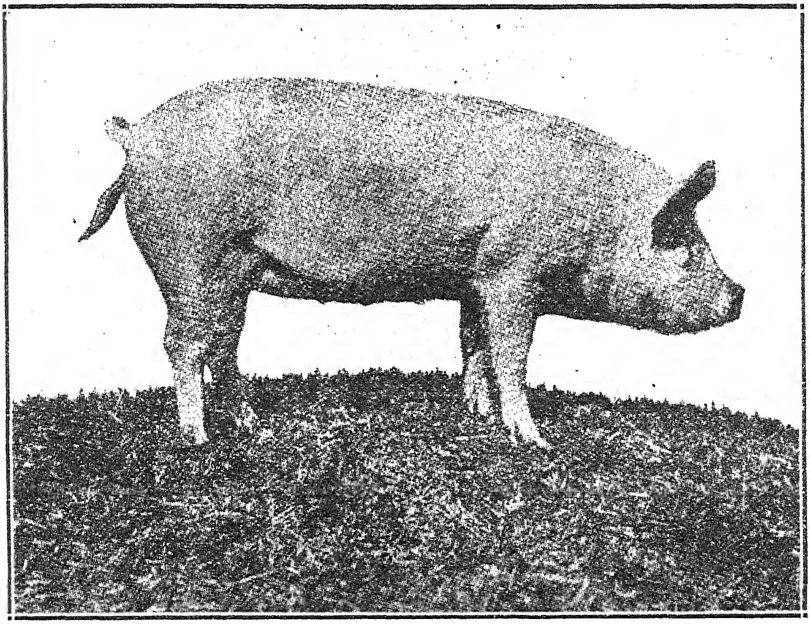


Fig. II. A select Baconer.
(From Pamphlet No. 40, Canadian Department of Agriculture.)

weight at which it can be marketed. Experiments in the Union of South Africa have recently shown that long baconers of the Large White x Large Black cross usually have the desired finish at from 200 to 215 lbs. farm weight, and short ones of this cross at from 185 to 200 lbs. A short baconer

of this cross at 210 lbs. will definitely be over fat. A long one, on the other hand, at 190 lbs. will be unfinished. It requires careful judgment to determine the correct degree of finish for marketing.

The Type of Carcase Required.—After the pig has been killed, bled, scalded, scraped and singed, the entrails, heart, liver and lungs are removed. The carcase then is weighed to obtain the dressed weight of the pig. This weight should be from 75 per cent. to 80 per cent. of its weight before slaughter. The carcase is then split and the backbone, head, tail, leaf fat, tenderloin, kidney fat and kidneys are removed. The two sides are now separate, and it is not until this stage that a reliable judgment can be made as to the suitability of the pig for bacon production. Figure III. shows desirable and undesirable bacon carcases.

The side should have a well-proportioned appearance. It should be *long* from ham to shoulder, light in the shoulder, and have a *full*, *plump* ham.

There should be an *even* covering of back fat, not exceeding 2¼ ins. over the shoulder and tapering slightly from shoulder to ham. An *uneven* layer of too *thick* or too *thin* back fat is a very serious fault. The belly and flank should also be *thick* and *full* of substance. There should be no signs of seedy cut (see next section), and the side should show no signs of bruises, boils, spots or cuts.

The following are some common carcase defects:—

(a) **Deficient Length.**—Not only is it desirable to have a long middle because of the relatively high value of the bacon obtained from it, but a short pig usually has other undesirable features, such as too much fat and heavy shoulders.

(b) **Back Fat too Thick or too Thin, or Uneven.**—These faults are among the most serious that a bacon carcase can have. At present the demand is for lean bacon, and too much fat is seriously discriminated against. An unfinished carcase, on the other hand, with too thin back fat, produces a soft, flabby side unsuitable for bacon production.

(c) **Heavy Shoulders.**—This part of the carcase has the lowest value per pound. A heavy shoulder is also generally associated with two other serious defects, viz., deficient length and too much fat.

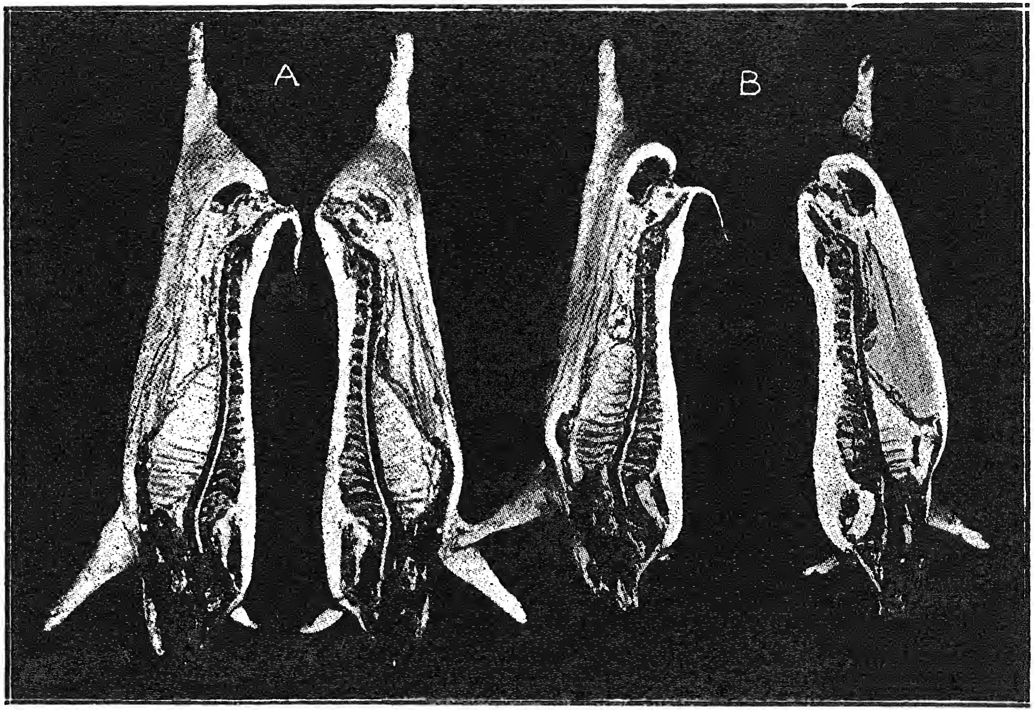


Fig. III. A. A desirable carcase with good length.
B. An undesirable carcase, short and too fat.
(From Economic Report No. 17, Ministry of Agriculture and Fisheries.)

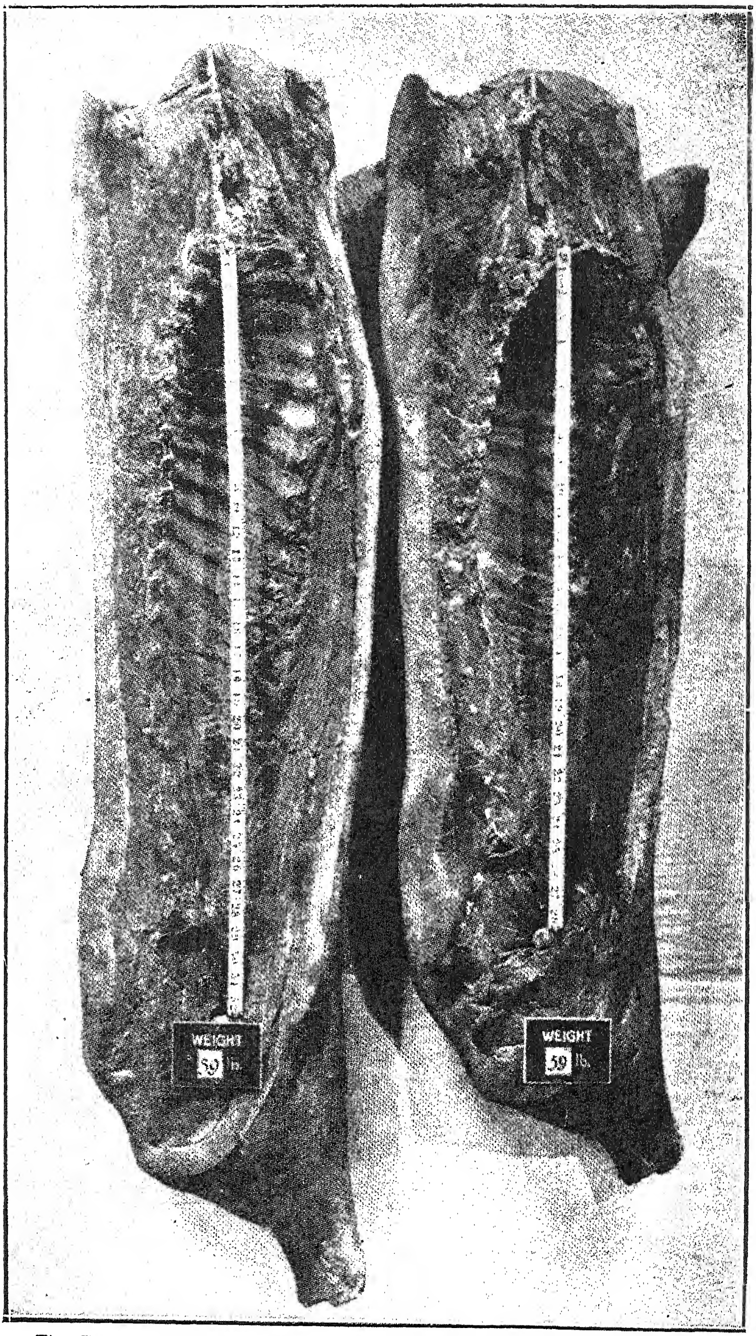


Fig. IV. Desirable and undesirable sides of the same weight. The shorter side is over-fat and is too heavy in the fore end.

(From Economic Report No. 17, Ministry of Agriculture and Fisheries.)

(d) **Thin Bellies.**—These are undesirable because of the flabby appearance they give to the carcase and the unsatisfactory rashers that are cut from them. Unfinished, badly bred and unthrifty pigs usually suffer from this defect.

(e) **Soft Fat.**—A soft carcase soon goes rancid. It has an oily and flabby appearance and is most undesirable. Unthrifty, slow maturing, unfinished pigs generally have soft fat. The feeding of peanuts, soy beans and sunflowers produce the same effect. Early maturing, thrifty, well-finished pigs are generally firm.

(f) **Seedy Cut,** found in the belly fat of pigs, is due to an infiltration of the skin pigment, and has a speckled appearance resembling small seeds. It is only visible in black pigs. Although in no way harmful, the discoloration spoils the appearance of the bacon and often results in the cutting out of large pieces of belly bacon to be used for rendering into lard.

(g) **Meat of Poor Quality.**—Some breeds or crosses produce coarse meat. The lean meat of an unfinished pig will usually be poorly marbled. Good quality meat is well marbled, light in colour and has a fine grain. Black pigs have darker coloured meat than white pigs. Generally, well bred and fed pigs have good quality lean meat.

(h) **Blemishes.**—Bruises, boils, cuts or spots on the carcase constitute blemishes and detract greatly from the general appearance and value of the carcase. Rough handling is the usual cause.

Factors which influence the Value of a Pig for Bacon Production.—The two most important factors are breeding and the feeding and management of the pigs.

(1) **Breeding.**—Certain types and breeds of pigs are unsuitable for production of lean, sizeable bacon. They may be too fat, too heavy in the jowl or shoulder, too thin in the belly or too light in the hams. Such types or breeds should not be used for bacon production. Even in the typical bacon breeds—Large Whites and Tamworths—we often find sows which produce pigs that are "off-type" and unsuitable for bacon production. Boars and sows which produce such pigs should be culled immediately from the breeding herd. Figure IV. shows desirable and undesirable sides.

The Characteristics of Different Breeds and Crosses.—There are two recognised distinct types of pigs: the lard (or fat) type and the bacon type. There is, however, an intermediate type which falls between these two extremes. A typical lard pig is short, wide and deep in the body, short on the leg and shows fatness throughout. A pig of the bacon type has, on the other hand, more length than the lard pig, and stands higher on the leg. It is of medium width and depth of body. The bacon type shows relatively little fat and has a decided tendency to leanness.

In Southern Rhodesia the different types are represented by the following breeds:—

Lard Type: (1) Berkshire; (2) Middle White.

Bacon Type: (1) Large White; (2) Tamworth.

Intermediate Type: Large Black.

In Canada the Berkshire has, by selective breeding, been changed to the bacon type, and in England a large percentage of the Middle Whites are also of the bacon type. In Southern Rhodesia, however, both these breeds are of the lard type. In this connection it may be pointed out that "type" within any of the breeds is not definitely fixed, and must be maintained by selection. Thus it is that, although the Large White and Tamworth breeds are of the bacon type, we often find sows or boars which throw progeny which are "off-type." Similarly, a Berkshire or Middle White sow may have progeny, some of which resemble the bacon type.

Suitability of the Different Breeds and Crosses for Bacon Production.—Recent investigations in the Union of South Africa on the suitability of the different types and breeds of pigs for bacon production have shown that—

(a) Berkshires or Middle Whites, either pure or crossed with any other breed or type, are generally unsuitable for bacon production because of their excessive fat, deficient length of side and heavy shoulders. The breeding of Berkshires or Middle Whites or their crosses for bacon production is therefore not recommended.

(b) The Large White and the Tamworth, either pure or crossed with each other or with the Large Black sow, produce the most suitable type of baconer. The Large White

x Large Black cross is superior to the Tamworth x Large Black cross, except in areas where white pigs suffer from sunburn and *cannot* be given sufficient shade to prevent sun scald.

(c) The pure Large Black is generally unsuitable for bacon production on account of its tendency to produce coarse flesh and inferior bacon conformation. The Large Black sow is, however, retained for crossing with the Large White and Tamworth boars on account of its availability and its hardy, prolific and motherly qualities.

(2) **Feeding and Management.**—"Feeding" and "management" are as important as "breeding" in the production of select baconers, and a well-bred baconer, if wrongly fed and managed, will not develop into a select pig, although it may have the inherent ability to do so. Wrong feeding and management may result in soft fat, too thick or too thin and uneven back fat, slow maturity, expensive gains, poor quality meat, stunted, unthrifty and poor type pigs.

Common Errors in Feeding and Management.—The following practices should be guarded against:—

(a) *Under-feeding and the use of Unbalanced Rations.*—These result in slow growing, stunted, unthrifty pigs that make expensive gains. Bad feeding may cause the fat to be soft and the carcase to be of poor quality. Usually the faster the pig grows the cheaper it is to produce and the better the quality of its meat.

(b) *Incorrect Finish.*—An unfinished pig is undesirable, and usually produces a flabby carcase with soft fat, a thin belly and poor quality meat. It is of importance to feed the pig until it has the correct finish without allowing it to get over-fat.

(c) *The Use of Excessive Fattening or Oil-Containing Feeds.*—Some feeds should not be used for bacon pigs. Kaffir corn has a tendency to produce too much fat. Peanuts, soy beans and sunflowers produce soft, oily fat, and should not be fed to baconers.

(d) *Poor Housing, Bad Sanitation, etc.*—These all tend to impair the general health and well being of the pig, and so prevent it from growing out economically or producing

the quality of bacon which it is capable of doing under proper conditions.

THE BREEDING HERD.

Selection.—Particular attention should be paid to the selection of stock for the breeding herd, as on their suitability or otherwise will depend to a large extent the success of the business. The pigs selected should be typical of the breed, pure-bred, and, if possible, registered. Cross-bred or grade-pigs should *not* be used. Breeding stock should not be selected too young. The boar should not be chosen under six months or the gilts under three to four months of age. Even at these ages it is hardly possible to form an accurate estimate of their future development. It is important to select the breeding pigs from sows that are known to have *produced* and *reared* large uniform litters of the *correct* type.

The head, conformation and carriage of the boar should show *character* and *masculinity* without being coarse. The sows should show *femininity*, *character*, and *no* signs of masculinity. Both sexes should have *good* length, be relatively *fine* and *light* in the shoulder and jowl, *strong* in the back, with a slight arch from the shoulder to the rump. The ribs should be sufficiently well sprung to indicate constitution, and the sides should be smooth, and blend well with the fore- and hind-quarters. The hams should be full, well developed and well let down into the hocks. The legs should be short and strong and particular attention should be paid to the pasterns, which should be strong and straight. There should be evidence of *quality* throughout. Quality is indicated by a smooth, clean-cut appearance, a fine skin, fine silky hair, fine bones and light shoulders.

The sow should be of a *quiet disposition*, as a nervous and irritable sow often kills a large proportion of its progeny, and is seldom a good doer. The udder should be sound and there should be not less than six pairs of well-developed teats. In the gilt the teats should be well developed and not have the appearance of small "buttons." Hard lumps in the udder and blind teats should be watched for in a mature sow.

The Breeding Age.—The best age at which to breed young gilts will depend on their development. Well-developed gilts, weighing 200 to 250 lbs. and over at eight

months of age, can be put to the boar. A gilt bred too young or before it has developed sufficiently can only rear properly two or three piglets. This small number will not only affect her udder development, but will also greatly increase the cost of production of the young pigs. If such a gilt is allowed to rear larger litters the strain may permanently stunt its growth and spoil it as a breeder. On the other hand, some pure-bred breeders allow their gilts to grow too old and over-fat before breeding them. This is usually the case with show pigs, and it is an undesirable practice, because it increases the cost of the young pigs and may even cause temporary or permanent sterility in the sow.

Under average conditions it is unwise to use a boar until it is a year old. It should be used sparingly at first. Experience has shown that over-use of the boar pig will frequently injure its future breeding powers.

The Gestation Period.—The usual period between successful service and farrowing is from 114 to 115 days, or about "three months, three weeks, three days." The following gestation table gives the date of farrowing for sows served on certain dates:—

Gestation or Breeding Table.

Date served.	Date due.	Date served.	Date due.
January 1.	April 25.	July 1.	October 23.
January 16.	May 10.	July 16.	Nov. 7.
February 1.	May 26.	August 1.	Nov. 23.
February 16.	June 11.	August 16.	Dec. 8.
March 1.	June 23.	Sept. 1.	Dec. 24.
March 16.	July 8.	Sept. 16.	January 8.
April 1.	July 24.	October 1.	January 23.
April 16.	August 8.	October 16.	February 7.
May 1.	August 23.	Nov. 1.	February 23.
May 16.	Sept. 7.	Nov. 16.	March 10.
June 1.	Sept. 23.	Dec. 1.	March 25.
		Dec. 16.	April 9.

Breeding Season.—The sow, if properly fed, comes on heat every three weeks, unless she is pregnant or nursing a litter. The period between heats is about three weeks (21 days), although it often varies from 18 to 23 days. The "heat" usually lasts for three to four days, and as the ova

are usually shed about 30 to 35 hours after the beginning of heat and do not retain their vitality for more than a few hours, the sow should be served during the first or second day of heat. Where market conditions are secure, it is usually the best practice to have all the sows farrow at more or less the same time. A sow on heat will show a swelling of the vulva and general excitement, and will follow other females about. The condition of the boar and sow at service have an important effect on the number of young born. The sow should be in improving condition and the boar in a vigorous, active state.

Number of Litters per Year.—The more young pigs a sow produces and rears successfully per annum the lower will be the cost of production of the weaners. The object should be to get as many litters in as short a time as possible. To let a sow rear one litter and then "board" her for the rest of the year is bad economy. The optimum to aim at is two litters per year. This number, however, will be a heavy drain on the sow and she should therefore be well fed and cared for while nursing and during pregnancy. To obtain two litters per annum the young must be weaned at eight weeks of age and the sow served when she comes on heat, four to six days after weaning.

Size of Litters.—Some sows will farrow up to and over 20 piglets at a time. A sow usually has 12 to 14 teats, and it is therefore of little use for her to farrow more than this number. In addition, the piglets in such large litters are usually weak at birth. The most profitable size of litter to rear will depend on the number of teats and the milk yield of the sow. Few sows can rear more than 10 *thrifty* pigs. Gilts, because of their lower milk yield, should not rear more than 6 or 7 with the first litter. To have a herd average of 8 or more thrifty pigs weaned is considered very satisfactory.

Weaning Age.—With good feeding and management the young pigs should be weaned at about 8 weeks of age, when they should have an average weight of 35 to 40 lbs. and over. If they are not well developed at that time, weaning should be a little later.

Castration and Marking.—These operations should be performed at from 4 to 6 weeks of age and *not* a few days before or after weaning. For castration use clean, sterilised instruments, and put some disinfectant and fly repellent on the wound. At the same time the young pigs should be ear-marked (by means of a clipper) according to some definite system. The key below illustrates a satisfactory system.

One notch on the inside of the right ear equals 1.

Two notches on the inside of the right ear equals 2.

One notch on the outside of the right ear equals 3.

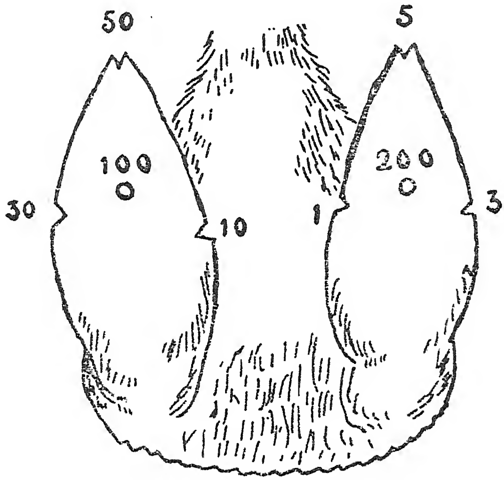


Fig. V. A system for ear-marking pigs.

One notch on the outside and one on the inside of the right ear equals 4.

One notch at the tip and one on the inside of the right ear equals 4.

One notch at the tip of the right ear equals 5.

One notch at the tip and one on the inside of the right ear equals 6.

One notch at the tip and one on the outside of the left ear, and one notch on the outside and one on the inside of the right ear equals 84, and so on.

With this system pigs can be marked from 1 up to 500 or over 600.

Pig Recording.—In progressive pig raising countries a system of pig recording rather similar in principle to the ordinary system of milk recording has come into use. Production and feed records are kept of all sows and their progeny, and carcase records are obtained when the baconers are slaughtered. By this means it is possible to determine which sows are the producers of large litters which use their feed economically and turn out into satisfactory baconers. By breeding from these sows only the productivity and profitableness of the herd is much increased.

All pig farmers should maintain some system of pig recording. The subject is too large a one to treat here, but particulars of systems suitable for different sets of circumstances can be obtained from the Department of Agriculture.

(To be continued.)

METHODS OF HARVESTING IN RELATION TO THE DRY-OUT OF MAIZE.

By R. D. Hampton.

Owing to the large amount of wet maize offered for export during recent years, the last Maize Grading and Export Conference requested the Department of Agriculture to institute enquiries and carry out experiments to ascertain the effect of different methods of harvesting on the rate of drying out of the grain.

This proposal was put into effect, and in addition to general advice on the matter published in the *Rhodesia Agricultural Journal,* a series of experiments were carried out last season on a field of maize at the Tobacco Experiment Station, Salisbury.

The soil in question consisted of a good type of sand of average fertility which had received 150 lbs. of bone and superphosphate and had been sown to maize underplanted with cowpeas for two years in succession.

The maize crop was planted on the 5th December, 1930, and half of the field was stooked on the 23rd April, 1931. The remaining half was left standing. The estimated yield was seven bags an acre.

In all, twenty-one trial reapings were carried out, six dealing with stooks of 8 ft. diameter, five with stooks of 14 ft. diameter, five with stooks of a 36 ft. length by 6 ft. wide, and five with the standing crop.

In reaping from the stooks, the cobs selected for moisture test were in all cases chosen from the centre of the stook and every care was taken to obtain fair average composite samples from each reaping.

Unless otherwise stated, the grain was shelled immediately it was reaped; composite samples were then drawn at once and placed in air-tight containers and the moisture content was ascertained by the usual Brown-Duvel moisture test.

Details of the trials carried out are shown in the following table:—

TOBACCO EXPERIMENT STATION, SALISBURY: MAIZE MOISTURE EXPERIMENTS.

Sample No.	Method of Reaping.	Date Reaped.	Period between Reaping and Shelling.	Date Shelled.	Date Tested.	Moisture Content.
1.	ex stooks 8 feet diameter	11.6.31	Reaped and shelled at once	11.6.31	12.6.31	13.9 per cent.
5.	ex stooks 8 feet diameter	11.6.31	Remained on stover 7 days	18.6.31	19.6.31	13.0 per cent.
7.	ex stooks 8 feet diameter	11.6.31	*Remained on stover 7 days	18.6.31	19.6.31	12.7 per cent.
8.	ex stooks 8 feet diameter	—	Remained on stover 14 days	25.6.31	26.6.31	12.4 per cent.
18.	ex stooks 8 feet diameter	18.6.31	Reaped and shelled at once	18.6.31	19.6.31	13.6 per cent.
19.	ex stooks 8 feet diameter	25.6.31	Reaped and shelled at once	25.6.31	26.6.31	13.2 per cent.
2.	ex stooks 14 feet diameter	11.6.31	Reaped and shelled at once	11.6.31	12.6.31	14.7 per cent.
12.	ex stooks 14 feet diameter	11.6.31	Remained on stover 7 days	18.6.31	19.6.31	13.6 per cent.
13.	ex stooks 14 feet diameter	11.6.31	Remained on stover 14 days	25.6.31	26.6.31	12.9 per cent.
24.	ex stooks 14 feet diameter	18.6.31	Reaped and shelled at once	18.6.31	19.6.31	14.0 per cent.
25.	ex stooks 14 feet diameter	25.6.31	Reaped and shelled at once	25.6.31	25.6.31	14.0 per cent.
11.	ex stooks 36 x 6 feet	11.6.31	Reaped and shelled at once	11.6.31	12.6.31	14.6 per cent.
14.	ex stooks 36 x 6 feet	11.6.31	Remained on stover 7 days	18.6.31	19.6.31	13.8 per cent.
15.	ex stooks 36 x 6 feet	11.6.31	Remained on stover 14 days	25.6.31	26.6.31	12.4 per cent.
20.	ex stooks 36 x 6 feet	18.6.31	Reaped and shelled at once	18.6.31	19.6.31	14.2 per cent.
21.	ex stooks 36 x 6 feet	25.6.31	Reaped and shelled at once	25.6.31	26.6.31	13.4 per cent.
9.	ex standing crop	11.6.31	Reaped and shelled at once	11.6.31	12.6.31	13.1 per cent.
16.	ex standing crop	11.6.31	Remained on stover 7 days	18.6.31	19.6.31	12.4 per cent.
17.	ex standing crop	11.6.31	Remained on stover 14 days	25.6.31	26.6.31	11.8 per cent.
22.	ex standing crop	18.6.31	Reaped and shelled at once	18.6.31	19.6.31	12.9 per cent.
23.	ex standing crop	25.6.31	Reaped and shelled at once	25.6.31	26.6.31	12.4 per cent.

* The ears in this case were partially husked before being placed on the stover.

The results strikingly confirm the summary of advice published by the Department on this subject in the local press in March, 1931, and later in the *Rhodesia Agricultural Journal* for July, 1931.

If reasonable care is taken in the subsequent handling of the crop, stooking is not as conducive to excess moisture in the grain at shelling time as is often supposed. While it is true that in the case of the 8 ft. stooks, seven weeks after the date of stooking, the moisture content of the cobs taken from the inside of the stooks was .8 per cent. above that of the standing crop, yet by placing the ears upon stover for 14 days prior to shelling, the moisture content was reduced well below the maximum permitted for export.

It is also of interest to note that, by partially husking the ears, the rate of drying of the grain was considerably increased, so much so that ears treated in this way dried out .3 per cent. more in seven days than ears similarly placed on stover, but left entirely unhusked.

The tests made on 14 ft. stooks indicate that size is an important factor and that ears from stooks of this size contained .8 per cent. more moisture than those from 8 ft. stooks, and that fourteen days later the moisture content of the cobs in the larger stooks was 14 per cent., whereas in the smaller stooks it had fallen to 13.2 per cent.

The moisture content of the grain from stooks 36 x 6 ft. is somewhat higher than was expected, but these stooks did not appear to have been built quite wide enough at the base, and owing to their caving in at the centre, the air space was restricted and the ears were not afforded the maximum opportunity of drying out.

A point of particular interest in these results is the consistent rate of drying out of all ears placed on stover, and it appears that this is a safe and sure method of expediting a quick drying out of the grain.

Drying out of Standing Crop.—The rate of drying of the ears on the standing crop is also of importance. In fourteen days the cobs reaped from the standing crop and placed on stover, dried out from 13.1 to 11.8 per cent., while the moisture content of those remaining in the field unreaped, fell to 12.4 per cent.—.1 per cent. below the maximum

allowed in export maize. Many farmers do not realise how well standing maize may dry out in a short time, and often, if growers would but delay their reaping for another week or so, they would avoid much annoyance, delay and often serious loss through excessive moisture after shelling.

Two other tests were made on the rate of drying out of a standing crop of maize, namely at the Agricultural Experiment Station, Salisbury, and at the Government Farm, Gwebi. In the first case, starting on the 12th May, eight different samples were drawn from a field of maize each week. These samples were tested separately for moisture and the mean of the results was taken to be the average moisture content of the maize throughout the field on the date of sampling. On the Gwebi farm, only two samples were drawn each week.

The following results were obtained:—

Salisbury Experiment Station—

Date.	Moisture Content.
13.5.31	17.2 per cent.
21.5.31	15.1 per cent.
28.5.31	13.6 per cent.
4.6.31	13.5 per cent.
11.6.31	12.6 per cent.
18.6.31	12.5 per cent.
25.6.31	11.9 per cent.

Government Farm, Gwebi—

4.6.30	21.3 per cent.
21.6.30	18.8 per cent.
27.6.30	15.5 per cent.
4.7.30	15.1 per cent.
12.7.30	13.4 per cent.
19.7.30	12.6 per cent.
28.7.30	12.1 per cent.

In the case of the Salisbury Experiment Station, it will be noticed that very little drying out took place between the 11th June and the 18th June, the reason being that drying conditions during that week were very poor indeed, the number of hours of daily sunshine being very much below the average for the time of year.

The following report from a grower who has for several years been troubled with wet maize is striking testimony to the harvesting methods recommended.

Since our maize had been wet and turned down by the graders for the past three seasons, we decided this year to try the method of reaping advocated in the Journal. For the first time we have been able to deliver clean and dry maize to the station from July onwards and have experienced no trouble or delay in having it taken over for export.

Instead of riding mealies straight to a large dump after reaping from stooks, the cobs were laid in small heaps on piles of maize stalks and left there for not less than three weeks.

We found the damage by ants was negligible and one year's costings indicate that the extra cost entailed in so handling the maize can be set off against—

1. A full day's shelling contract from the first day, owing to the dryness of the ears.

2. No bother or loss of time in restacking wet maize, or stacking in a particular manner to enable air to circulate through the stack.

"RESPICE FINEM."

THE "HIGH SPEED" SUCTION GAS PRODUCER.

By B. G. Gundry, A.I.Mech.E.

Through the courtesy of the inventor, Major J. A. Macdonald, D.S.O., M.C., of Kenya Colony, the writer has been afforded opportunities of conducting tests on the "High Speed" Suction Gas Producer, which has now been patented in forty countries throughout the world.

The results obtained were highly satisfactory, and there appears no reason why this plant should not meet the great demand which exists in this and other African colonies for cheap power for agricultural and transport purposes.

The design of this producer is very simple. As will be seen from the accompanying diagram, it consists primarily of the producer drum "A," a water tank "D," a cooling chamber "G" and a cleaner or scrubber "M." All these, with the exception of the water tank, are constructed of 16-gauge sheet iron with welded joints to render them completely air tight.

The operation of starting and running the plant is as follows: The engine is started up in the ordinary way on petrol, and, by means of a suitably arranged valve on the induction system, a certain proportion of the air necessary for its running is drawn through the producer system. The air valve "K" is closed, and the air therefore enters the system via the twyer "B," which consists of a short length of iron pipe passing through a flange bolted to the drum. A lighted torch, consisting of a piece of cotton waste or asbestos packing soaked in petrol, is held at the mouth of the twyer, and in a few seconds the charcoal, with which the drum has been previously filled, is well alight.

The water is now turned on by the fine adjustment valve "E" to flow at a fairly rapid drip. This water is drawn

into the fire, which is by now a small but intensely hot furnace (similar to a blacksmith's forge), and is immediately vaporised and decomposed to combine with the charcoal to form an inflammable gas.

This gas is drawn through the cooling chamber into the scrubber, which it enters by means of a pipe set tangentially to the periphery of the drum. This gives it a whirling motion round the cone "H," and the heavier particles of dust which it may contain are thrown down into a shallow oil sump. At the same time it is mixed with the requisite amount of air, which is admitted in the correct proportion by opening the valve "K."

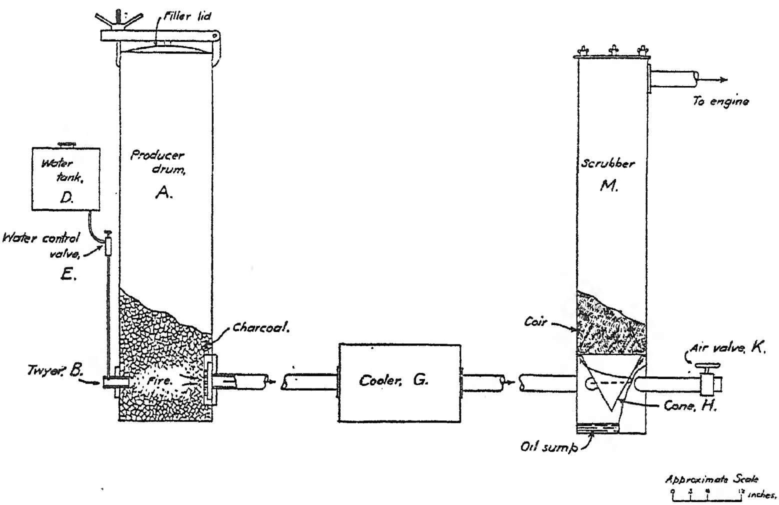


Diagram of the "High Speed" Suction Gas Producer.
(A producer of this size would be suitable for an engine of from 15 to 30 h.p.)

The mixture of gas and air is now drawn up into the body of the scrubber, where it passes through a filtering material such as sisal or cocoanut fibre steeped in oil. From here it passes direct to the engine. A sufficient quantity of gas is available to run the engine in less than five minutes from the time the charcoal is lighted, and the petrol may then be completely turned off, and the producer requires no further attention until the supply of charcoal or water is exhausted. The producer can be refilled with charcoal in a few seconds, and the engine can be restarted on gas without the use of petrol.

It might well be imagined that the fire in the producer would rapidly spread throughout all the charcoal in the drum, but this is not the case, as it remains confined to the small area between the twyer and the outlet pipe. The drum remains so cool a few inches above the level of the twyer that it can be touched with the hand without discomfort.

Charcoal from various woods has been used in this producer, including msasa, mdondo, gum (rostrata and salignum), and commercial charcoal of unknown origin. From general observations it appears that there is little difference in the gas-producing qualities of these woods, although accurate comparative tests have not yet been made. It may be safely assumed, however, that the amount of gas produced from any charcoal will be more or less proportional to its specific weight. Charred mealie cobs, although rather light, appear to give excellent results.

It is important to ensure that the charcoal used is free from sand and dirt, as such becomes fused into a solid mass in the furnace and lowers the efficiency of the producer.

It may be found that certain Rhodesian timbers are definitely unsuitable on account of the high percentage of silica they contain, but it is believed that in most cases such silica is concentrated largely in the bark, whether by the natural process of growth or whether, as the writer is inclined to believe, it is deposited externally in the form of dust by the wind, is not known, but in either case the trouble may be overcome by the simple process of stripping the bark from the timber before it is converted into charcoal.

It must be realised that an engine designed specially to run on pertol or paraffin cannot under ordinary conditions give the same output of power when run on gas. In order to obtain the best results possible it is necessary to increase the compression ratio of the engine to about 7: 1, and to re-adjust the ignition timing to permit of a considerably greater degree of advancement than is required when running on petrol.

In some engines, particularly those on tractors, the induction system is designed so that the in-going charge is considerably pre-heated; this is an undesirable feature when it is desired to run the engine on gas, as it is essential

that the engine should receive the greatest weight of gas possible at each charge. For the same reason it is sometimes advisable to enlarge or simplify unduly restricted or tortuous inductive pipes. Such alterations are difficult to make on some engines and relatively simple on others.

The High Speed Gas Company, which has been formed in Salisbury to handle the producer in Rhodesia, is now engaged in investigating and experimenting with various makes of tractors and lorries with a view to determining the cheapest and most convenient method of adapting the producer, and it is hoped that before long certain necessary fittings will be standardised so that the process of converting the more popular types of vehicles will be reduced to a matter of routine.

It must be remembered that the loss of power in internal combustion engines, due to altitude alone, which may be taken roughly as four per cent. for every thousand feet above sea level, would in most parts of Southern Rhodesia amount to from sixteen to twenty per cent.

In the case of agricultural tractors any loss of engine power decreases the efficiency of the tractor to a far greater extent than such a loss would indicate at first sight. Since approximately fifty per cent. of the engine power is required to move the tractor under, say, ordinary ploughing conditions, it follows that if the power of the engine is reduced for any reason by twenty-five per cent., its pulling power is reduced by fifty per cent., as fifty per cent. of its original power is still required to move the tractor itself.

In many cases it would be necessary to reduce the load on the tractor by reducing the number of plough discs or shares, which would increase the actual ploughing time, but if it is necessary to perform the same amount of work in the same time as with paraffin, then the only alternative is to use a somewhat larger tractor.

It may not be generally known that fruitless enquiries have been made of several English manufacturers on behalf of this Government, for tractors specially designed for use with suction gas, as it was realised that when an efficient producer was available it could not be used to the best advantage until such a tractor was also available.

Major Macdonald is now in France, where he is demonstrating his plant at the request of the French Government, and it is possible that before long a really suitable type of tractor may be obtainable.

After exhaustive trials and satisfactory tests the local manufacturers, Messrs. the "High Speed" Gas (Rhodesia), Ltd., are now turning out plants to suit tractors, lorries and stationary engines.

RESULT OF PLOUGHING TEST MADE WITH A "JOHN DEERE" 15-27 H.P. TRACTOR,

fitted with "High Speed" Suction Gas Producer.

The compression ratio of the engine was increased to approximately 7 : 1 by attaching aluminium plates to the pistons, and the induction system was modified to avoid pre-heating and to permit of the change over from petrol to gas being easily made. A John Deere four-furrow disc plough with one disc removed was used for the test.

The test was made on commonage land to the east of the Salisbury-Borrowdale road. The ground, a heavy loam, had been worked the previous season, but at the time of the test was dry and hard.

Two stoppages were made—one of five minutes' duration caused by the needle valve of the water supply becoming choked owing to the tank not being fitted with a proper strainer, and one of three minutes owing to the tractor stalling in a patch of extra heavy ground.

The charcoal used was made from gum from which the bark was stripped before burning, and, as broken for use, weighed 20 lbs. per cubic foot.

The draw-bar horse power was measured over a distance of 500 feet. The depth of ploughing was measured from the surface of the unploughed ground to the bottom of the furrow, and the depth given, six inches, is the average of a large number of measurements taken at random.

SUMMARY OF RESULTS.

Date: 23rd October, 1931.

Make of tractor: John Deere 15-27 h.p.

Make of plough: John Deere four-furrow disc with one disc removed.

Total area ploughed: 1.08 acres.

Nett ploughing time, exclusive of stoppages: 1 hour 48 minutes.

Area ploughed per hour: .6 acre.

Quantity of charcoal consumed per acre: 54 lbs.

Average h.p. at draw-bar: 11.03 h.p.

Average depth of ploughing: 6 inches.

RESULTS OF TWO TEST RUNS MADE ON A BROCKWAY MOTOR LORRY,

fitted with a "High Speed" Suction Gas Producer.

The Brockway lorry with which these tests were made is rated by the makers to carry a maximum load of 2,500 lbs. It is fitted with a platform body and has travelled, according to the mileage indicator, rather over 10,000 miles.

The compression ratio of the engine was increased to approximately 6.5 to 1 by attaching aluminium plates to the piston heads, and the distributor re-set to permit of the ignition being advanced considerably more than is possible on the normal setting for petrol.

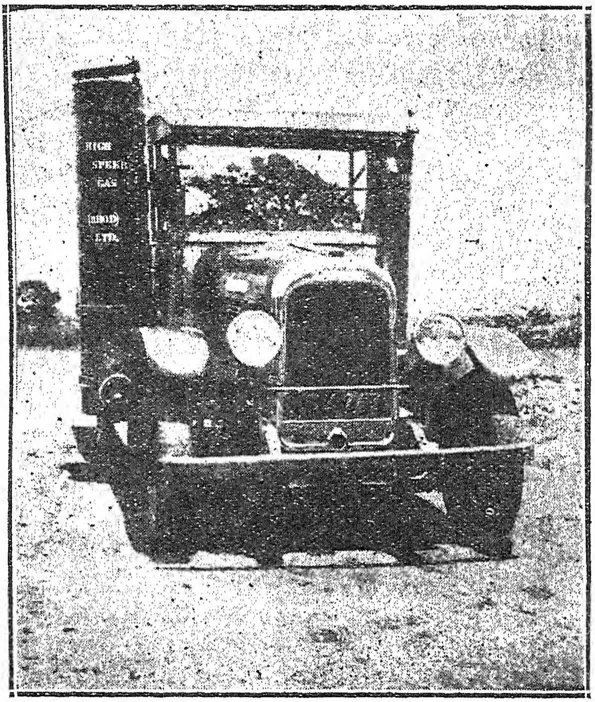
The load carried on the first run consisted of three drums of tar and three passengers, and, on the second run, four drums of tar and two passengers. The weight of the driver and producer is not included in the "useful" load specified.

The route traversed was from the Government Irrigation Office to a point approximately ten miles out on the Salisbury-Marandellas road and back.

The average speed on the first run with an 83 per cent. load was 15.34 m.p.h., and on the second run with a 97.5 per cent. load, 15.93 m.p.h.; and it must be noted that the maximum speed was deliberately restricted as far as possible to 25 m.p.h., and this speed was only exceeded for one or two brief periods.

The charcoal used was made from freshly-cut msasa wood from which the bark had been stripped before burning. The consumption was ascertained by measuring the volume occupied by the charcoal in the producer before and after the run.

The amount of water consumed by this producer is known to be so small (approximately one gallon to 80 miles) that it was not measured.



Lorry adapted to use "High Speed" Suction Gas.

GENERAL OBSERVATIONS.

No involuntary stoppages were made on either run, nor was any trouble in the running experienced. Apart from an occasional readjustment of the needle valve on the water supply, which is conveniently situated within easy reach of the driver, neither the gas producer nor engine received any

attention whatever. The engine ran very sweetly throughout and remained extraordinarily cool.

It was noted that this lorry did not perform particularly well on second gear, but on low gear there appeared to be ample power available to negotiate any main road hill.

CONCLUSION.

As the primary object of these runs was to check the consumption of charcoal, it is of interest to draw a rough comparison between the relative cost of running on gas and petrol.

Assuming the price of clean, carefully prepared charcoal in Salisbury to be 2s. 6d. per bag of three cubic feet, excluding the cost of the bag itself, and that the normal petrol consumption (as stated by the owner of the lorry) to be 12 miles per gallon, the costs of the two fuels for a run of 20 miles with a full load would 1s. 4½d. for charcoal as against 4s. 7d. for petrol at 2s. 9d. per gallon.

SUMMARY OF RESULTS.

Date	19.11.31	20.11.31
Useful load carried	2,075 lbs.	2,439 lbs.
Percentage of rated load ...	83%	97.5%
Distance run	20.2 miles	19.9 miles
Total time of run	79 minutes	75 minutes
Average speed	15.34 m.p.h.	15.93 m.p.h.
Total volume of charcoal consumed	1.55 cu. ft.	1.64 cu. ft.
*Total weight of charcoal consumed	24.33 lbs.	25.74 lbs.
Weight of charcoal consumed per mile	1.2 lbs.	1.3 lbs.
Weight of charcoal consumed per ton mile	1.3 lbs.	1.19 lbs.

* The weight of a sample of the charcoal as used was determined as 15.7 lbs. per cubic foot.

An application of this producer which must not be overlooked is that for stationary plants for grinding or shelling mealies, electric lighting, etc. For such purposes the producer is eminently suitable, as there is no restriction to the size of the engine which may be selected for any particular job.

The engines of old motor cars, which through an accident or rough use were no longer serviceable, have been successfully set up and run as stationary power plants.

GWEBI PRODUCE PRICES.

Hull-less oats	40/- per bag of 150 lbs.
Large Black sunflower seed ...	14/- per bag of 100 lbs.
Dolichos beans	35/- per bag of 200 lbs.
Linseed	60/- per bag of 200 lbs.
Linseed (quantities under 100 lbs.)	4½d. per lb.
Sweet potato tubers (Calabash Leaf)	6/- per bag of 150 lbs.
Napier fodder roots	6/- per bag of 40 lbs.
Sweet potato cuttings (Calabash Leaf)	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.
Pumpkin seed	1/1 per lb.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

SYMBIOSIS IN RELATION TO AGRICULTURE.

Symbiosis may be defined as an internal partnership between two different kinds of organisms, where the partnership is distinctly beneficial to both.

Several other kinds of partnership between organisms are known to exist, and different terms are employed to indicate the relationship; thus *commensalism* indicates a partnership very similar to symbiosis, but an external one. Perhaps the best known illustration of commensalism is the mutually beneficial arrangement between hermit crabs and sea-anemones: endo-parasitism is an external arrangement which is beneficial to the parasite only and is injurious to the host.

Symbiosis exists between organisms of many different kinds.

The first case which was definitely proved was that of lichens, and it has since been shown to be of very common occurrence throughout a large portion of the animal and plant kingdoms. Thus symbiosis is known to occur between plants of different kinds and between plants and animals.

Inoculation of Pine-plantation Soils.—In many parts of this country pines will not flourish unless the soil is first inoculated with a special fungus which is necessary for their development. Fortunately the process of inoculation is a very simple matter, as it is only necessary to mix a very little of the soil containing the fungus with the seed-bed soil—or with that used in the pricking-out tins. If pine trees have already been planted out in suitable soil and climatic conditions and are not getting away—that is, if they are pale in colour and refuse to grow—it is highly probable that the fungus is missing, and a little infected soil should be scattered over the surface or forked in around the trees. The relationship between the fungus and the plant is a complicated root association which is a further illustration of symbiosis known as a mycorhiza.

The name "mycorhiza" was coined by the German botanist Frank in 1885 to indicate his belief that the root, together with its associated fungus mycelium, constituted an independent organ of great importance. He reported an invariable and intimate association between fungi and the roots of forest trees, especially oak, beech, hornbeam, conifers, etc., the arrangement being, in his opinion, not parasitic, but definitely beneficial to both.

Inoculation of Legumes.—The effect of a leguminous crop on other crops which follow in the rotation appears to be invariably beneficial. Investigations have shown that a marked residual effect may occur even though the legume crop is harvested and the tops removed. Until quite recently it has been thought that this effect is due to the legume plant being able to fix nitrogen with the aid of bacteria which live in the nodules on the roots. Because of this fact it was understood that a legume crop left the soil heavily infected with nitrogen-fixing bacteria. Recent investigations seem to indicate, however, that the residual effect is possibly due to the addition of organic matter to the soil through the heavy root growths which often penetrate to a great depth. This is of particular interest, because it would probably throw some light on the beneficial effect of cotton on succeeding crops, although this effect could certainly not be attributed to the usual bacterial action, since cotton is not a legume.

Legumes play such an important part in agriculture that a great deal of attention has been devoted to the nitrogen-fixing activities exhibited by them, and a good deal of interesting information has been obtained. It has been ascertained that the relationship between the bacteria in the nodules on the roots and the plants themselves is not one of chance parasitism, but of symbiosis. The bacteria concerned with nitrogen-fixation may be considered in two groups, those which live free in the soil and those which form tubercles on the roots.

Bacillus radicicola, or some biological strain of this species, is the organism which causes the tubercles on the roots of the legumes. This symbiotic association between the bacillus and the plant is of the greatest importance, as the bacteria are able—in some manner not yet clearly ex-

plained—to assimilate free nitrogen from the air and fix it for the use of the host plant. In exchange for sugar and other foods, which the bacteria obtain from the legume root tissues, it is assumed that they have the power of combining the nitrogen obtained from the air into compounds necessary for the elaboration of proteins and that in the form of waste products these become available for the host plant. If the soil is sufficiently rich in nitrogen, or if the soil conditions are unsuitable for the active multiplication of nitrogen-fixing bacteria, or if a suitable strain of nodule organisms is not present in the soil, no nodules are produced on the plant. Under such circumstances the whole nitrogen requirements are taken direct from the soil, and if sufficient supplies are not available, the plants suffer. The inoculation of legume seeds with a suitable strain of organisms is, therefore, always desirable, and this practice is being more and more generally adopted.

Recent investigations show that the various strains of organisms known under the name of *Bacillus radicicola* fall into distinct groups, each of which is capable of producing nodules on a limited number of host plants. The organisms belonging to any one group cannot, as a rule, produce nodules on plants belonging to any other group, although a few such cases have been claimed. Thus soya beans and lupines each form separate groups in which they appear to stand alone, and the strain concerned is not the same as is required by the broad bean, which occupies a group with the sweet pea, lentil and narrow leaved vetch. Crimson, alsike and wild white clover fall into another group, and this is distinct from that containing white sweet clover, bur clover, yellow trefoil and lucerne. The peas fall chiefly into two distinct groups. In one the common garden pea, the field pea and the hairy vetch all occur; in the other we have the cow-pea, partridge pea, velvet bean and lima bean. It is interesting to note that the organisms associated with many species of acacia belong to the same strain as that concerned in the inoculation of the cow-pea and the lima bean group.

C.K.B.

SOUTHERN RHODESIA MILK RECORDING SCHEME.

The Minister of Agriculture has approved of the adoption of the following regulations for the official and semi-official milk recording and testing of dairy herds in Southern Rhodesia.

These regulations came into force on 1st January, 1932.

GENERAL CONDITIONS.

(1) Whenever possible, the Official Milk Recorder will be present at the milking previous to the first milking taken for the check test in order to see that the cows are all milked dry.

(2) No test for butter fat will be taken by the Recorder until eight days have elapsed since the cow calved, or until such time as her milk, when boiled, does not coagulate.

(3) All records shall commence not earlier than the fifth day after calving, the day on which the cow calved being counted as the first day.

(4) There shall be not less than two or more than three milkings in the twenty-four hours, provided that the Dairy Officer may grant permission for a cow yielding over eight gallons per diem to be milked four times daily. The number of milkings per diem shall be stated on the certificate or statement of performance when issued.

(5) The Government shall have the right to make use of the data obtained in respect of the testing and recording of grade and pure-bred herds for propaganda or other purposes, provided that the names of the owners or breeders and the names of their animals shall not be published without the consent in writing of the farmers or breeders concerned.

(6) All farmers or breeders whose herds are recorded and tested must furnish brief particulars of the feeding of the cows under test; such information to be entered by the owner or his representative each month on the weights sheet.

The quantity of concentrates or roughage fed daily and the condition of the veld, if running on same, must at least be stated.

(7) Notwithstanding what is laid down in regulation 5, the completed records of all cows in respect of which a certificate or statement of performance has been issued, together with the names of the owners and, whenever possible, brief particulars of feeding, will be published from time to time in the *Rhodesia Agricultural Journal* or in such other publication as the Department may approve of, provided that no records will be published in any publication other than an Agricultural Journal without the consent in writing of the owners or breeders concerned. Similarly herd averages may be worked out annually and published in the same Journal.

(8) All testing fees shall be paid to the Milk Recorder upon the occasion of each visit; fees for surprise tests, however, as provided under regulation 24 (g), may be paid to the Milk Recorder on his subsequent visit to the farmer or dairyman concerned.

The Department shall have the right to refuse further service and to cancel the Milk Recorder's visits to any farmer or breeder who fails to comply with this requirement.

(9) All breeders, farmers and dairymen whose herds are officially or semi-officially recorded and tested will be required to provide the Milk Recorder with suitable board and lodging, free of charge, during the whole of the period it is necessary for him to remain on their property. When considered necessary, they may also be required to convey the Recorder, free of charge, from the railway station to the farm, and likewise convey him back to the railway station or to the next farm he has to visit, as the case may be.

(10) The Dairy Officer shall have the right to refuse to issue a certificate or statement of performance in respect of any cow in regard to the accuracy of whose record he is not satisfied.

(11) (a) The feeding of whole milk, cream or eggs to cows under test is prohibited, as is also the dosing of them with stimulants, medicines or concoctions calculated in the opinion of the Dairy

Officer to temporarily and abnormally affect their production, and certificates will not be issued or records published in respect of cows so fed or treated.

(b) Owners may be required to furnish to the Dairy Officer a declaration as to the foods and quantities of each comprising the rations fed to their cows during the period they are under test, and, if deemed necessary, must permit samples of the different foods to be taken for analysis.

(12) Notwithstanding anything to the contrary which may appear to be indicated in these regulations, no person shall have the right to demand the services described in this scheme, if for any reason whatsoever the Department is not in a position to provide such services.

(13) In the event of any difference of opinion in regard to the interpretation of any of these regulations, or in the event of any question arising for which no provision is made in these regulations, the Dairy Officer shall be the sole arbiter in such cases, and his decision in the matter shall be final.

(14) Copies of these regulations can be obtained from the Dairy Officer, Department of Agriculture, Salisbury.

OFFICIAL MILK RECORDS.

Only pure bred registered cows, which shall include all animals registered in the South African Stud Book or other recognised South African or Overseas Herd Book, shall be officially recorded and tested.

(15) All pure bred registered cows entered for the official test shall be submitted, once in every thirty days, to a forty-eight hours' check test by the Department's Official Milk Recorder; during this period the milk of each cow shall be weighed and tested for butter fat at each and every milking.

(16) The official testing and recording of a herd of less than 10 cows will only be undertaken if circumstances permit.

(17) The following scale of fees will be charged to breeders or farmers who agree to enter their whole herd for the official test and who undertake to comply with the conditions laid down in regulation 18.

(a) The minimum charge for a visit by the Department's Official Milk Recorder shall be £1.

(b) For this fee the breeder or farmer will be entitled to have up to 10 cows officially tested at the same time and on the same premises.

(c) For every cow above 10, the fee for official testing will be 1s. per cow per visit.

(d) Breeders who have entered their pure bred herd for official test and who desire also to have unregistered or grade cows tested at the same time and on the same premises will be charged at the rate of 3d. per grade cow per visit. Only a 24 hours' check test will, however, be taken of such unregistered or grade cows.

(18) All breeders wishing to avail themselves of the scale of charges provided in the foregoing regulation shall, when applying to have their herds tested, undertake to comply with the following conditions, viz.:—

(a) Every cow in the herd must be officially tested and recorded as she calves down and every time each calves so long as the herd is under official test; provided that exemption may be obtained from the Dairy Officer in respect of cows suffering from sickness or accident or for other special reasons which, in the opinion of such officer, constitute sound and valid grounds for granting exemption; no such exemption, however, shall be granted on account of adverse climatic conditions except in very exceptional and abnormal circumstances.

(b) No cow shall be withdrawn from the official test before she has completed 300 days from the commencement of her record or has ceased to yield milk before the expiration of that period except in cases of sickness or accident, when permission to withdraw may be granted by the visiting Official Milk Recorder, who shall then report the circumstances to the Dairy Officer, who may, if in his opinion there is no justification for withdrawal, require the cow to complete her test.

(c) The keeping of daily weights will be optional, and owners preferring not to keep such will be allowed to record the weight of milk yielded by each cow at each milking on two days each week; the days on which the weights are to be taken must be stated by the owner when making application to have his herd tested, and shall be rigidly adhered to unless permission to alter them is obtained from the Dairy Officer. In cases where daily weights are not taken, the total weight of milk for the month (30 days' period) shall be calculated by multiplying the average daily weight of milk yielded on the days the milk has been weighed by 30; the weights of milk recorded by the Official Milk Recorder during his forty-eight hours' test also being reckoned for this purpose.

(d) Official certificates of performance shall be issued in respect of cows which complete a minimum of 240 days under test or which qualify within that period in respect of butter fat requirements for the Advanced Register, Register of Merit, Shorthorn Dairy Record Standard, or any other standard accepted by any recognised Breed Society, and, at the discretion of the Dairy Officer, in respect of such cows which may have died during test or been withdrawn owing to sickness or accident before the expiration of that period. All such certificates shall be endorsed stating whether the record has been based on daily or twice-weekly weighings. No certificate, however, shall be issued for a cow until she has recalved after completing her test or has failed to recalve at the expiration of eighteen months from the commencement of her test, whichever is the earlier date. Date of recalving shall be entered on the certificate, or, in the event of failure to recalve within eighteen months, a note shall be made to that effect. Owners not requiring certificates for any particular animals must notify the Dairy Officer to that effect as soon as the cow concerned has completed her test; otherwise certificates will be issued for each animal recorded.

Official certificates issued in respect of pure-bred registered cows shall be forwarded to the Breed Society or Association concerned, from whence they will be returned to the breeder or owner.

(19) Breeders who are unwilling to submit their whole herd for the test, but who wish to have only a few selected animals tested, shall be allowed to have such officially tested under the following scale of charges:—

(a) The minimum charge for a visit by the Department's Official Milk Recorder shall be £2.

(b) For this fee the breeder will be entitled to have up to five cows tested at the same time and on the same premises.

(c) For every cow above five the fee for official testing will be 2s. per cow per visit.

(20) Breeders who enter cows under this regulation must record the weight of milk yielded by each cow under test at every milking, and the conditions relative to the issue of certificates laid down in regulation 18 (d) of this notice shall also apply to them.

(21) If at any time more applications for official recording and testing of pure-bred cows are received than can at the time be undertaken by the Department, preference shall then be given to applications for the testing of whole herds under regulations 17 and 18 of this notice.

(22) (a) Applications for the official testing and recording of pure-bred registered cows under this scheme must be made on the form issued for the purpose and obtainable from the Dairy Officer, Department of Agriculture, Salisbury, to whom the form after completion must be forwarded.

(b) All entries of cows for the official test must be made before calving, and entries cannot be accepted in the case of herds in which cows are not already being tested unless completed application forms are sent in not later than twenty-one days prior to the date on which the first cow to be tested is expected to calve.

(c) All owners entering cows for the official test will be supplied free of charge with the necessary

official weighing books in which to enter the weight of milk yielded by each cow.

(23) All official records shall be for a lactation period of 300 days; owners may, however, continue cows in test up to 365 days, and a statement of the performance during this extended period will be included in the certificate when issued.

SEMI-OFFICIAL MILK RECORDS.

(24) Owners of pure-bred registered cows who do not desire to enter their herds for the official test, and farmers and dairymen who wish to record and test their herds of grade cattle, may place their herds under semi-official test, as provided hereunder:—

(a) In the case of herds which are placed under semi-official test the minimum charge for a visit by the Department's Official Recorder will be 7s. 6d.; for this fee the farmer will be entitled to have up to 10 cows tested at the same time and on the same premises; for every cow over this number the fee for testing will be 3d. per cow per visit.

(b) Only cows whose calves are hand-reared shall be recorded and tested.

(c) Every cow in the herd must be recorded and tested every lactation, so long as the herd is under test; if the owner refuses to agree to this stipulation, the Department shall refuse to record and test his herd. Cows suffering from sickness or accident, and such as are over 10 years old or for any other valid reason, may be exempted at the discretion of the Milk Recorder.

(d) Each cow shall be submitted once in every 60 days to a 24 hours' check test by the Department's Milk Recorder; during this test period the milk of each cow shall be weighed at each and every milking, and a composite sample of the morning's and evening's milk of each cow shall be taken and be tested for butter fat.

(e) The keeping of daily weights shall be optional, and owners preferring not to keep such may record the weights of milk on one fixed day in each

week and have the two months' yield worked out from the average of such weights and those obtained by the Recorder during his 24 hours' check test. Weighing sheets will be provided free of charge. All weighing sheets must be kept up to date and will be collected every 60 days by the Milk Recorder.

(f) The semi-official testing and recording of a herd of less than ten cows will only be undertaken if circumstances permit.

(g) In addition to the bi-monthly visits from the Milk Recorder as provided under (d), surprise visits may also, and at any time, be paid by the Milk Recorder to farmers or dairymen whose herds are recorded under this scheme; during these surprise visits each cow under test shall be submitted to a 24 hours' surprise check test. The expense of one such surprise test, if made, shall be borne by the farmer or dairyman concerned, and the fees charged therefor shall be as provided under (a).

(25) No cow, unless she has ceased to yield milk, shall be withdrawn from the test unless permission for withdrawal has been obtained from the Milk Recorder.

(26) Statements of performance will be issued in respect of each cow which produces a minimum of 150 lbs. of butter fat during a lactation period of not more than 300 days.

(27) Application for the semi-official testing and recording of dairy herds shall be made on the form supplied for the purpose and obtainable from the Dairy Officer, Department of Agriculture, Salisbury, to whom the form, after completion, should be forwarded. Entry forms, which can be obtained from the Dairy Officer, must be filled in by the farmer or dairyman concerned for each cow entered for the semi-official test; these forms must be handed to the Milk Recorder. To enable the Milk Recorder to identify each cow tested, the owner must brand or mark each animal in manner approved by the Milk Recorder, and must renew such brand or mark from time to time as may be necessary, except in the case of broken colour animals, which can be identified

by means of the colour diagrams on the back of the entry form.

(28) The testing and recording of any grade herd under this scheme may be discontinued at any time, if, in the opinion of the Dairy Officer, the owner of such herd is not deriving full advantage or benefit from this service.

SALES.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

Spineless Cactus Slabs (Blades), Algerian Variety: 20 slabs, 5s.; 50 slabs, 10s.; 100 slabs, 17s. 6d.

Stocks are limited, and delivery cannot be undertaken until January next.

Kudzu Vine Crowns: 10 crowns, 5s.; 20 crowns, 7s. 6d.; 50 crowns, 15s.; 100 crowns, 25s.

Delivery during January for dry land. Owing to pressure of other operations, it is not possible to deliver Kudzu crowns during December. The prices are for delivery free at purchaser's nearest station or siding in Southern Rhodesia. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

HOW TO MAKE USE OF THE FENCING LAW.

As the provisions of the "Fencing Ordinance, 1904," have been applied to the whole of the Colony, it is competent for any landowner to require his neighbours to join in or contribute to the construction of fences on mutual boundaries, in such proportion as may be agreed upon between them. To this end he should serve a notice in writing on the person he desires to contribute, specifying the boundary to be fenced, the kind of fences and mode of erection proposed. (*See specimen letter A.*)

If within three months no agreement is arrived at in respect of any of the above points, the matter is to be settled by arbitration. (*See specimen letter B.*)

If either of the parties fails to carry out any of the work of construction that he has agreed to do, or has been allotted by an arbitrator, the other party may carry it out and recover the share of the cost that the first party should have contributed, in any Court of competent jurisdiction.

The person called upon to contribute to the construction of a dividing fence may, by giving notice within one month of the amount being fixed for which he is liable, pay such amount by equal annual instalments, with interest at 6 per cent. per annum added. (*See specimen letter C2.*) If the capital amount does not exceed £100, the payments may be extended over five years, and if the amount exceeds £100, the payment may be extended over ten years. In a schedule to the Ordinance there is given a table for calculating the amounts payable every year for five or ten-year periods.

When an owner is absent or cannot be found, or any land is unoccupied, the owner of any adjoining land who wishes him to contribute to the cost of a fence must advertise at least once a month for three months in the *Gazette* and a paper circulating in the district, requiring him to contribute. (*See specimen notice D.*) He may then obtain an order from

the Magistrate authorising him to proceed with the construction, and in due course a certificate of the amount due by the owner of the adjoining land. This certificate must be lodged with the Registrar of Deeds, who will make an entry in respect of the land affected, which entry will constitute a hypothecation of the land.

Tenants, excepting those whose unexpired term of lease does not exceed one year, are liable to pay interest at the rate of 6 per cent. per annum on half the cost of construction, and tenants who have the right of purchase are liable to have any sum paid by the owner for construction of fence added to the purchase price.

Owners of land on either side of dividing fences are liable for the cost of repairs in equal proportion. An owner can serve on his neighbour a notice requiring him to assist in repairing such fence (*see specimen letter E*), and if the second owner refuses or neglects to do so, after one week the first owner can make the repairs and recover his share from the second. Fences destroyed by accident may be repaired without notice. If the fence is damaged through the neglect of either of the parties, he only is liable for the whole cost of repairs.

The Ordinance does not affect any substantial fence already erected at the time of the coming into operation of the Ordinance.

If the owner of any land shall have erected by 10th December, 1926, a fence on the boundary of his land, and any other person shall adopt any means by which such fence shall be rendered of beneficial use to himself, he shall be liable to pay the owner of the fence interest at 6 per cent. per annum on half the then value of so much of the fence as he makes use of, and shall also be liable for half the cost of repairs.

Any person erecting a fence on land covered with bush is entitled to clear the bush for a width not exceeding six feet on either side of such fence, and to remove any tree standing in the direct line of such fence. The cost of clearing may be added to the cost of the fence in cases where any part of the cost of the fence is to be recovered from another party.

Where a river forms the boundary of contiguous lands, but is not capable of resisting the trespass of animals liable to be impounded, it shall be competent for the owners to agree upon such a line of fence on either side of the river as shall secure such fence from the action of floods; and in the event of their not agreeing upon such a line of fence, and whether any or what compensation in the shape of an annual payment shall be paid to either party for loss of occupation of land, the question shall be settled by arbitration.

If the owner of any land shall clear the same of inflammable materials for the space of fifteen feet from any boundary fence, and the owner of the contiguous land shall neglect so to clear his land, such owner shall be liable for any damage done to the fence by fire due to such neglect, and is required to make good the damage within one month, failing which the neighbouring owner may make good the damage at the expense of the owner in default.

Every person engaged in constructing or repairing a fence under this Ordinance may enter upon the contiguous lands, if necessary, at any reasonable times and do any reasonable acts thereupon that may be required for the construction or repair of the fence, but he may not enter upon any cultivated ground, garden, plantation or pleasure ground or cut down or lop any fruit or ornamental trees or shrub without the consent of the owner.

Any owner to whom any amount may be due by any person by way of contribution towards the construction of a dividing fence may call upon such person to pass a mortgage bond upon his land. (*See specimen letter F.*) If the said person shall refuse or fail to pass such mortgage bond the owner may notify to the Registrar of Deeds the fact that the amount is owing and no mortgage has been passed. (*See specimen letter G.*) The Registrar of Deeds shall then notify the person named, the fact and particulars of the notification received from the first party, and if no objection is lodged within three weeks the amount of the debt is registered in the Deeds Office and no transfer or mortgage on the property can be passed until the bond above referred to has been duly passed. Should any objection be raised, no entry shall be made in the Deeds Office registers except with the consent of the said person or upon the order of a competent Court.

An "owner" is described in the Ordinance and amending Act as—

(a) Any person, company, co-partnership or public body in actual occupation of or entitled as owner to occupy any land alienated from the British South Africa Company, or entitled by virtue of any certificate or document conferring a right to claim any land from the British South Africa Company.

(b) The Council or other governing body of any Municipality or Corporate Town, in respect of all lands to which or to the use of which the inhabitants of such Municipality or Corporate Town have acquired or may hereafter acquire a common right.

(c) Any person lawfully occupying or holding land in accordance with the provisions of any agreement, made before or after the taking effect of this Act, empowering the Government to allot lands upon the promise of title, subject to the fulfilment by the allottee of prescribed conditions.

It should be noted that the Government is not amenable to the fencing laws in respect of boundary fences between Crown land and privately owned land and between native reserves and privately owned land, nor is it legally bound to contribute towards the cost of erecting fencing along declared roads passing through privately owned land.

The Government has, however, accepted a limited amount of financial responsibility for the cost of erecting the three above-mentioned types of boundary fences. In other words, sums of money are voted annually in the Votes of the Department of Lands, the Native Department and the Department of Mines and Works, from which claims in respect of boundary and road fences can be met, but only up to the amount voted annually for this purpose.

Applicants desiring Government assistance towards the cost of fencing boundaries between Crown lands and their farms should therefore apply to the Department of Lands, and those desiring to fence between their farms and native reserves, to the Chief Native Commissioner. The Department of Mines and Works should be approached for a contribution towards the cost of fencing along declared roads.

SPECIMEN LETTERS.

A.—Letter calling upon a neighbour to join in the cost of a fence.

Dear Sir,—

I beg to inform you that I propose to erect a dividing fence on the border of this farm and that of...................... and call upon you, in terms of section 6 of the "Fencing Ordinance, 1904," to contribute towards the cost thereof. The line concerned runs from................to...................

I propose the erection of..............*(here state kind of fence to be erected, material, cost, etc.)* and that.............. *(here state proposals for erection, by what means, cost, etc.)*

Yours faithfully,

B.—Letter calling upon a neighbour to go to arbitration.

Dear Sir,—

With reference to my letter of...................(see *A*) in view of our failure to arrive at an agreement with regard to ....*(here state points on which no agreement arrived at)*, I now propose that the matter should be settled by arbitration in terms of clause 7 of the "Fencing Ordinance, 1904," and have nominated Mr.......................to act as arbitrator on my behalf. Will you please nominate an arbitrator to act for you?

Yours faithfully,

C1.—Letter acknowledging A and agreeing to share expenses.

Dear Sir,—

I have your letter of.................regarding the erection of a joint fence, and in reply beg to state that I am prepared to agree to the terms suggested and to pay half cost of all expenses *(or any other proposals as the case may require)*.

Yours faithfully,

C2.—Letter acknowledging A and requesting to pay by instalments.

Dear Sir,—

I have your letter of.................regarding the erection of a joint fence. In reply, I beg to state that I am pre-

pared to agree to the fence suggested, but wish to avail myself of the provisions of section 9 of the "Fencing Ordinance, 1904," and to pay the amount of my share of the cost by instalments, with interest at the rate of 6 per cent. per annum, extending over a period of.................years.

Yours faithfully,

(See in reply specimen *F*.)

D.—Notice in Gazette *and Newspaper calling on owner whose address is unknown to contribute.*

To A.B., owner of farm............................situated in the District of.......................

Take notice that I intend to fence my farm................. and in terms of sections 5 and 11 of the "Fencing Ordinance, 1904," I hereby call upon you to contribute towards the cost of construction of the fencing of our common boundaries from......................to......................

(Sgd.) C.D.

E.—Letter calling on neighbour to assist in repairing a boundary fence.

Dear Sir,—

I beg to inform you that the boundary fence dividing our farms....................and.................is out of repair (*here state nature and extent of damage*). I therefore beg to call upon you to assist in repairing the same in terms of section 15 of the "Fencing Ordinance, 1904."

Yours faithfully,

F.—Letter calling upon neighbour to pass Mortgage Bond.

Dear Sir,—

I beg to acknowledge your letter of....................(see specimen *C*) and note that you wish to pay your share of the cost of our joint fence by instalments. I am agreeable to this, provided you pass a mortgage bond over your farm in terms of section 29 of the "Fencing Ordinance, 1904" (*or other security can be arranged by mutual agreement*).

Yours faithfully,

G.—Letter to Registrar of Deeds notifying debt owing by neighbour for fencing.

Sir,—

In terms of section 30 of the "Fencing Ordinance, 1904," I beg to notify you of the undermentioned debt incurred in connection with a joint boundary fence between the farms ....and......................., and to request you to register the same in the Register of Deeds.

Name of farm............................

Amount owing..........................

Situation and name of property in respect of which Bond has been demanded...................

Date of the grant or transfer of the said property to the said person........................

The above amount has been agreed upon, *or* ascertained according to law, and the person above named has been duly called upon to pass a mortgage bond and has failed to do so.

I am,

Your obedient servant,

FARMING CALENDAR.

February.

BEE-KEEPING.

In most parts of the two Rhodesias this month is one of fair activity for all bees, there being as a rule quite enough nectar, pollen, etc., available for all ordinary purposes of rearing, building cells, etc., and working generally for the due upkeep of the colony for the present as well as for the coming winter. Whether there will be any surplus honey for them to store will depend upon what crops the farmer may have on hand at this time, as the usual flora of the land will not supply it until the regular second flow of the year is due, which should be in March to April, according to the season.

Watch carefully for robbers, though, with well attended hives and due care in handling, there should be little to fear in this direction; strong, well filled hives can always repel robbers, which are only successful with weak colonies, and these no apiarist should ever have under his care. Mark well last month's advice, i.e., to have everything in readiness for dealing with unexpected new swarms that may be required as they may come, for nothing is more disconcerting or annoying than to be unready when the time arrives. This applies especially to any swarms that may come from the apiary, for a few days only of neglect of such a hive may easily lead to the moth taking early possession of the combs, and in practically a few hours destroy fully drawn-out combs that would otherwise be of much value for after working upon. Such combs, as they are available, should at once be packed away in an air- and moth-tight box or tin for after usage.

CITRUS FRUITS.

Newly-planted citrus trees should be kept free of weed growth likely to exclude necessary air and light for their normal and healthy development. Citrus trees planted in February seldom give satisfactory results; late planted trees do not mature their new growths before winter, and they are more susceptible to winter injury or the ravages of disease or insect pests. The early planted cover crops will be fit to plough under by the end of the month. Do not delay this operation for fear of the rains ending abruptly. If this occurs, great difficulties will be experienced when attempting to plough in the green crops. Keep all young shelter belt trees free of weed growth, and loosen the soil round their stems fairly frequently to eliminate possible ant injury. This is one of the best months for budding citrus trees, either in the nursery or grove—trees that are to be top worked to profitable varieties. Late out-of-season fruit that may have set during December-January should be stripped from the trees. This fruit is valueless for export, and if allowed to mature, will affect the main crop setting of fruit.

DECIDUOUS FRUITS.

When sufficiently mature, plough under cover crops. This should be possible towards the end of the month.

Summer pruning should be completed early in the month; little or no advantage will be derived from trees treated when the new wood reaches maturity.

Do not allow fruit to become over-ripe, then expect remunerative prices for it. If it is harvested at the correct stage, then well graded and neatly packed, good prices may be expected for the surplus fruit sold.

This is a good month for budding deciduous fruit trees.

CROPS.

Cultivate, and keep on cultivating as weather permits, to destroy weeds. Continue to look out for stalk borer, and, if infection is discovered, deal with infested plants as advised in January notes. Watch witch weed and continue cultivating and hand pulling it. Plough under witch weed, smother and trap crops. Where practised, maize can be under-planted with sweet potato vines after the last cultivation for the following season's requirements. Potatoes and ground nuts will probably need to be ridged again. Catch crops of quick maturing beans, such as tepary bean, also buckwheat, can still be sown. Keep down all noxious weeds. This work can be undertaken on wet days. Make veld grass hay whenever a few days of fine weather permit. Early mowings provide the best hay. Seed beds of onions for early winter planting can be sown towards the end of the month. Keep potatoes in a cool shed, well ventilated. Pick over any potatoes in storage and remove bad ones. Continue to make as much farm manure as possible. Begin to ride manure and place in heaps handy to the lands to be manured.

DAIRYING.

This is normally the flush season as far as dairy produce is concerned; dairy cattle are usually in good condition and cows of average capacity should be able to subsist and maintain a full flow of milk on veld grazing alone. Calves may be given a few hours' exercise on bright, sunny days; young stock, however, should not be allowed to run and graze with the herd, and are best kept in a cool, airy pen opening on to a small shady paddock, where they can obtain a little exercise.

A good quality of sweet hay and water should always be available for young calves.

Cream deteriorates very rapidly under the conditions which obtain at this time of the year, so that every precaution should be taken to keep the cream as cool as possible pending despatch to the creamery. As there is a greater strain than usual on the separator during the flush months, frequent oiling is necessary, and care should be taken that the machine is mounted on a level foundation. The separator and all other dairy utensils must be cleaned immediately after use. First rinse the utensils with cool or lukewarm water, then wash thoroughly with boiling hot water, washing soda and a scrubbing brush; scald finally with boiling water.

The cheese in the storeroom is apt to develop mould during wet weather. If the cheese is well made and pressed and has a smooth rind, this mould is merely superficial and will not penetrate into the body of the cheese. Rubbing the cheese with a cloth moistened with a weak solution of formalin or permanganate of potash usually checks the development of mould. During these months care must be taken not to use over-acid milk for cheesemaking, and great care should also be taken of the starter. If this latter shows any signs of gasiness or develops any disagreeable flavour or odour it should be discarded and replaced by a fresh, clean starter. The cheese storeroom must be kept dark and flies excluded.

FARMING CALENDAR.

February.

BEE-KEEPING.

In most parts of the two Rhodesias this month is one of fair activity for all bees, there being as a rule quite enough nectar, pollen, etc., available for all ordinary purposes of rearing, building cells, etc., and working generally for the due upkeep of the colony for the present as well as for the coming winter. Whether there will be any surplus honey for them to store will depend upon what crops the farmer may have on hand at this time, as the usual flora of the land will not supply it until the regular second flow of the year is due, which should be in March to April, according to the season.

Watch carefully for robbers, though, with well attended hives and due care in handling, there should be little to fear in this direction; strong, well filled hives can always repel robbers, which are only successful with weak colonies, and these no apiarist should ever have under his care. Mark well last month's advice, i.e., to have everything in readiness for dealing with unexpected new swarms that may be required as they may come, for nothing is more disconcerting or annoying than to be unready when the time arrives. This applies especially to any swarms that may come from the apiary, for a few days only of neglect of such a hive may easily lead to the moth taking early possession of the combs, and in practically a few hours destroy fully drawn-out combs that would otherwise be of much value for after working upon. Such combs, as they are available, should at once be packed away in an air- and moth-tight box or tin for after usage.

CITRUS FRUITS.

Newly-planted citrus trees should be kept free of weed growth likely to exclude necessary air and light for their normal and healthy development. Citrus trees planted in February seldom give satisfactory results; late planted trees do not mature their new growths before winter, and they are more susceptible to winter injury or the ravages of disease or insect pests. The early planted cover crops will be fit to plough under by the end of the month. Do not delay this operation for fear of the rains ending abruptly. If this occurs, great difficulties will be experienced when attempting to plough in the green crops. Keep all young shelter belt trees free of weed growth, and loosen the soil round their stems fairly frequently to eliminate possible ant injury. This is one of the best months for budding citrus trees, either in the nursery or grove—trees that are to be top worked to profitable varieties. Late out-of-season fruit that may have set during December-January should be stripped from the trees. This fruit is valueless for export, and if allowed to mature, will affect the main crop setting of fruit.

DECIDUOUS FRUITS.

When sufficiently mature, plough under cover crops. This should be possible towards the end of the month.

Summer pruning should be completed early in the month; little or no advantage will be derived from trees treated when the new wood reaches maturity.

Do not allow fruit to become over-ripe, then expect remunerative prices for it. If it is harvested at the correct stage, then well graded and neatly packed, good prices may be expected for the surplus fruit sold.

This is a good month for budding deciduous fruit trees.

CROPS.

Cultivate, and keep on cultivating as weather permits, to destroy weeds. Continue to look out for stalk borer, and, if infection is discovered, deal with infested plants as advised in January notes. Watch witch weed and continue cultivating and hand pulling it. Plough under witch weed, smother and trap crops. Where practised, maize can be under-planted with sweet potato vines after the last cultivation for the following season's requirements. Potatoes and ground nuts will probably need to be ridged again. Catch crops of quick maturing beans, such as tepary bean, also buckwheat, can still be sown. Keep down all noxious weeds. This work can be undertaken on wet days. Make veld grass hay whenever a few days of fine weather permit. Early mowings provide the best hay. Seed beds of onions for early winter planting can be sown towards the end of the month. Keep potatoes in a cool shed, well ventilated. Pick over any potatoes in storage and remove bad ones. Continue to make as much farm manure as possible. Begin to ride manure and place in heaps handy to the lands to be manured.

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ENTOMOLOGICAL.

Maize.—The first brood of the stalk borer matures this month, and the young of the second brood may be found amongst the younger leaves. Weeds should be kept down.

Tobacco.—Stem borer, leaf miner and budworms are the chief pests likely to be troublesome. Plants in the field found infested with the first two insects should be heavily pruned or destroyed. The budworm caterpillars can usually be hand picked during the process of topping. (See "Rhodesia Agricultural Journal," December, 1927.)

Potato.—Ladybirds and tuber moth may call for attention. The latter, when very bad, sometimes causes considerable wilting of the crop besides attacking tubers. The ladybirds may be destroyed by spraying with arsenate of lead 1 lb. to 16 gallons of water.

Cabbage Family.—All members of the family are liable to be attacked by the sawfly and webworm. The sawfly may be effectively controlled by dusting during a dry spell with Paris green and slaked lime (1 lb. Paris green and 20 lbs. slaked lime).

Melon Family.—The most important pest is the melon fly, which "stings" the fruit of all species of gourds. Destroy all badly "stung" fruit and spray remainder thoroughly with arsenate of lead (2 ozs. in 4 gallons of water) to which 2½ lbs. of cheap sugar has been added.

Deciduous Fruit.—Apples, pears and late peaches suffer chiefly from fruit moths, which puncture the fruit. No remedy available except covering the trees with netting.

Fig.—The fruit is liable to the attack of the fig weevil. All infested fruit and all wild fruit should be collected and destroyed. The borer in the stem may be killed by inserting a little carbon bisulphide into the burrow and sealing it up.

Poison Baiting.—Poison baiting against surface beetles, cutworms, etc.: No really effective bait has yet been discovered for cutworms, but the following poisoned bait is recommended for surface beetles, etc.: Paris green 1 lb., 180 lbs. maize meal. Mix thoroughly in dry state and add water until the material is of the consistency of a dough. Roll into small balls and place under shade. Spread in the evening.

FLOWER GARDEN.

Sow carnations, phlox, pansy, verbena, gilias, larkspur, dianthus and pentstemon. The flower garden should be now looking its best, nearly all plants being in bloom. Old and dead flowers should be constantly removed, except when the seed is required. Seeding of the plants shortens their flowering period. All runners and climbers should have constant attention, and be tied up and trained, otherwise they will be damaged by the wind. Dahlias, chrysanthemums and carnations will require staking, as they become top heavy when in flower. Make the first sowing of winter-flowering sweet peas.

VEGETABLE GARDEN.

Sow now—Beans, beet, cabbage, cauliflower, lettuce, peas, onions, carrots, parsnips, turnips, endive, kohl rabi, rhubarb and all herbs.

FORESTRY.

Tree planting operations should be carried out on dull, showery days or late in the afternoons. Take care in setting out the plants, avoid bending the roots, and do not plant deeper than the plants were in the seed beds or trays. Steps should be taken to prepare seed beds for the slower growing species, i.e., pines, cypresses and callitris, and seed of these species should be sown for the following season's planting.

GENERAL.

This is a busy time for the farmer. Weeds will be very much in evidence and difficulty will be experienced in keeping them under. Stock will have fully recovered their condition, but ticks will be troublesome. The dipping tanks must be fully utilised now.

POULTRY.

Cockerels for future breeding should now have been selected, and those not good enough sold for killing. It pays far better to get rid of all of the latter, even if only at 1s. or 1s. 3d. per lb., than to keep them on, eating their heads off, in the hope of getting a better price. Those good enough for breeding, and they must be good, should be kept till about June; there is a demand for such up to this month. Any surplus at this time should be eaten or sold for what they will fetch. Of those selected for breeding purposes, the owner should keep the best one or two for his own use, with another as a reserve. No poultry keeper should sell his best stock, no matter how high a price is offered for it.

By the end of this month the birds selected for breeding should be mated up. If it is possible, the birds selected for breeding should be given a run on free range for three weeks or so before being put into the breeding pen and fed sparingly; better fertility and better chicks will be the result. If it is possible to run the birds selected for breeding away from the others during the whole of the breeding season, all the better. Any hens that become broody should be kept broody by setting a few china eggs under them until such time as eggs from the breeders come in. Broody hens at this time and for the next five months are valuable.

During the rainy season the scratching litter must be kept dry; if it gets wet it is useless.

Duck hatching can be continued all the year round; the main points are that the young ducks must be kept out of the sun and sleep on dry grass. Nothing is more fatal to ducklings than sun, and dampness at night; and the latter applies, too, to the adults. Unless a dry shed, with a dry, soft layer of chaff or sand, etc., covering the floor of it, is available, it is not wise to hatch turkeys till after the wet season is finished, for it will be labour, food and eggs wasted. If the young turkeys get wet they are almost certain to die. This and the feeding on wet mashes instead of dry food, chopped onions and thick milk are the chief reasons for non-success in the breeding of turkeys.

STOCK.

Cattle.—The recommendations for December apply equally to this month. Be careful that the condition of the bulls is maintained, especially in the case of well-bred animals. A bull in poor condition cannot be expected to sire a large number of calves. As far as practicable cut veld hay during this month. Usually the optimum relation of yield and composition occurs now. During this month, in addition to maize, some protein concentrate such as peanut cake or cotton-cake will generally be necessary in the dairy cow mixture to keep up a good milk flow. Increase the grain ration to bullocks which are being fattened on grass and add some protein concentrate to their feed to make good the deficiency of this nutrient in the grazing.

Sheep.—Continue as recommended for December. If heavy rains are experienced, a daily ration of half a pound of maize per ewe will help to keep them in condition. Those who favour autumn lambs must put the ram again with the flock in February, and should take steps to supply a little extra feed to fit the ewes for mating. Start putting in green feed for ewes due to lamb in April or May.

TOBACCO.

The early tobacco should now be ready for curing. Care should be taken to select only thoroughly ripe leaf for filling the barns, so that the cured product will be uniform. Topping, priming and suckering should be given attention. Selected seed plants should be carefully watched. New land intended for tobacco next year should be ploughed this month, so that all organic matter turned under may be converted into humus before planting time next season.

WEATHER.

This is often the wettest month of the year, with marked differences of from 10 inches to 15 inches on the eastern mountain ranges, 7½ inches over Mashonaland, 4 inches to 6 inches in Matabeleland, and least, but still some, rains in the Limpopo Valley. The rains may be expected to decrease in intensity after the middle of the month if the season is normal.

March.

BEE-KEEPING.

As the latter end of this month should herald the approach of the second and last real honey flow of the season, see that enough extra supers are ready for placing on hives as required, watching also that the fully drawn out combs of shallow frames that are on hand to fill them with are kept free from the wax moth; further, examine all supers that are already on the hives for this serious defect, though strong colonies will as a rule keep the combs free from this pest. March being usually a hot month, look well to the entrance; enlarge when and where necessary, and have ventilating lids on the tops of each hive. Extra ventilation can be provided for when required by placing small metal or wooden wedges underneath the top super, but not to be open enough to let out or in a single bee. Where quilts are noticed to have been eaten or more or less destroyed during the summer months, now is the time to make fresh ones so as to be ready for the closing down and the making snug of each hive when winter approaches; old flour bags or old deck chair canvas make capital quilts. Bees during this month will consume a quantity of water; see that some is always kept in the apiary in floating cork chips. This will save much labour and flight for them, as well as prolong their period of work and usefulness. As stated in last month's notes, flying swarms may be expected now any day, so prepare for their capture if required by having all details and items ready for immediate use. It is as well, however, at this date of the season to do without such swarms, unless the owner is prepared to feed them well during the winter months. March or April swarms, unless they are hived under conditions of providing all the frames, of fully drawn out old combs, do not as a rule have either the time or materials to provide for a strong colony before the winter sets in, and must perforce remain a weak one during that period. The axiom of every bee-keeper should be to let his colonies go into winter quarters brimming over with bees, not only to provide against the mortality that is bound to occur then, but to have a full hive to start the next season with.

CITRUS FRUITS.

Two thorough sprayings about this season, when the rains are usually practically over, at an interval of about two weeks, will often obviate the necessity for further work against scale insects until the beginning of the next wet season. If not already done, orchards should be ploughed and cross-ploughed and worked up into a really good surface, so that the cultivators can be kept going, say, every two weeks until it is necessary to irrigate, after which cultivation should be continued. If March prove a dry month, orange trees holding up a crop of fruit will probably require irrigation, but under normal weather conditions it should not be necessary. The same remarks apply as last month with regard to fruit moths. About the end of this month fall budding can be taken in hand, that is the insertion of buds that are intended to remain dormant until spring. This applies to higher altitudes, but in low country, where the growing season is extended, dormant budding should not be done until latter end of April.

CROPS.

Watch oats for rust, and, if badly infested, cut crop for hay as soon as weather permits. Ridge late potatoes, and if weather is dry prevent ridges from cracking, to check tuber moth infestation. Finish ploughing under all green manure crops while the ground is still moist enough to promote rapid decomposition. Late in the month begin to cut silage crops and ensile. Cut out barren maize plants and feed to stock or ensile. Cut Sudan grass for hay to permit of final late growth for autumn grazing. Reap any crops that are ready, and plough the stubbles **at once.** Lift ground nuts that are sufficiently matured. Watch for ground nuts making second growth; reap, and when sufficiently dry, place in cocks with nuts inwards and cover the top securely. Sow onion seed beds for winter crop. Watch the weather for hay-making and take advantage of fine spells. Towards the end of the month hay-making should normally be in full swing. Continue to plough all lands in succession immediately the crops are reaped from them. Vleis and irrigable lands should now be ready, or in process of being prepared, for winter crops. Early sowings of Algerian oats, barley or rye for green forage can be made. Allow any potatoes lifted to dry before storing them, but do not leave too long in the sun. Destroy witch weed and other noxious weeds. Continue to make all the kraal manure possible by throwing grass and litter into kraals, yards, etc. Begin to select in the field maize plants for seed purposes, and mark them with slips of coloured cloth. Press on with the breaking up of any virgin land which may have been stumped or cleared earlier in the year. Place orders for grain bags without delay. Early in the month silage pits should be cleaned out or, where necessary, new pits dug.

DAIRYING.

This is usually the most favourable month of the year for dairy operations. Cooler nights are now in evidence, and there is usually little difficulty in maintaining a low temperature in the dairy and cheese-room. If elementary precautions are taken, all cream should be first grade, and first-class cheese should be made, as a gassy condition of the milk is rare. Dairy cows, unless they are very high producers, can go without extra rations, because the grass is now in seed and grazing is ample. The cheese storeroom is generally full of cheese, and care should be taken to turn the cheese regularly. The windows and doors should be opened at night and closed in the daytime. A little mould on the cheese will not affect its quality, but if the mould is excessive the cheese should be rubbed daily.

Calves which are under four months old should be kept in and allowed to nibble at well-got hay; at the same time a little dry mealie meal and monkey nut cake will do them good and teach them to eat concentrates. An ample supply of clean water should be provided in the calf run.

ENTOMOLOGICAL.

Maize.—The stalk borers of the second brood may now be found in the stalks, but nothing can be done at this stage. Caterpillars sometimes attack the crop as a sequel to cultivation after grass weeds have made too much growth. The caterpillars attack the crop on account of their more natural food being suddenly destroyed. Prevention and not cure is indicated.

Tobacco.—The crop will by this time mostly have outgrown insect injury, but leaf miners and budworms may be in evidence. The latter are usually destroyed by hand when topping. Any plants affected with stem borer should be removed and destroyed.

Potato.—If ladybird beetles or caterpillars are injurious, spray with arsenate of lead (powder) 1 lb. to 30 gallons of water. Careful hilling should be attended to with the object of preventing and checking tuber moth attack.

Vegetable Garden.—If sawfly attacks plants of the cabbage family dust with Paris green 1 lb., fine sifted slaked lime 20 lbs. Against cabbage louse (aphis) wash plants frequently with a strong spray of water. Destroy blister beetles by hand. Plants of the melon family may be baited regularly with arsenate of lead (powder) 1½ ozs., treacle ½ gallon (or cheapest sugar 2½ lbs.), water 4 gallons, to keep down fruit flies. For leaf-eating caterpillars and beetles, etc., spray with arsenate of lead (powder) 1 lb. in 30 gallons of water on foliage which will retain water. Cabbages are best dusted.

Citrus Trees.—Collect and destroy infested fruit to keep down citrus codling. Fruit-piercing moths sometimes attack the fruit during the month, especially navels. They work at night and can only be dealt with at present by hand destruction. The trees should be watched for development of aphis and soft brown scale on the young growth and prompt measures taken. Resin wash at two-thirds standard strength is suitable.

Mosquitoes, House Flies, etc., may be very prevalent during March. Destroy breeding places. Poison or trap adult flies. Attend to screening of residence.

FLOWER GARDEN.

Flower seedlings for winter blooming should now be coming on, and should be planted out during showery or cloudy weather. Cuttings of carnations may now be made, and should be taken from selected plants which have borne the choicest blooms. The cuttings should be dibbled in half paraffin tins containing three parts sand to one of loam, and kept in a moist condition in a shady position sheltered from the winds. Make main sowing of winter-flowering sweet peas in a well-prepared and rich soil.

VEGETABLE GARDEN.

The sowing calendar is the same as that recommended for last month. Plant out from seed beds cabbage and cauliflower; care should be taken during this month, as the end of the rainy season approaches, to dig with a fork all the ground in the garden. The heavy rains settle this down hard, and as soon as the dry weather begins the soil cracks and lets out all the sub-soil moisture by evaporation. As soon as the rains cease entirely it is advisable to go over the ground and fine down with a rake, leaving some three or four inches of quite fine soil to act as an earth mulch.

FORESTRY.

Cultivation where necessary should be undertaken between the rows of trees planted out in previous months. If cultivation is carried out with the hoe, care should be taken not to pile earth round the base of the stems. New ground for next season's planting should be roughly broken up with the plough. Bulk plantings may be proceeded with during the month.

GENERAL.

At this time the condition of stock on the veld is usually good. It is well, however, to look ahead and make ready for the coming winter by the provision of winter feed in such forms as veld hay, silage, baled fodder from maize, manna, oats, teff, velvet beans, and the like, and by taking steps to ensure that water will be available for the stock in winter as near their grazing ground as may be.

POULTRY.

The breeding pens should have all been mated up by now, as the first chicks should be out by the beginning of April. Much more care should be used than is usually the case when selecting birds for breeding. Only the very best, i.e., the strong, healthy, vigorous ones from the best layers, should be chosen. A pamphlet on "Selection and Mating for Improvement" can be obtained on application to the Editor or the Poultry Experts. This deals fully with the subject. Always keep an eye on the male bird; many are apt to get thin and run down in health, due to their allowing their mates to eat all the food. Such birds are better breeders than those that chase their mates away from the food. Every male that is being bred from should be given a good meal by himself each day, to ensure health and vigour. The incubator should be thoroughly overhauled, cleaned and disinfected before the eggs are put in.

STOCK.

Cattle.—Arrangements for winter feed should be pushed on. For a well balanced winter ration, in addition to good quality veld hay, a succulent feed such as maize silage, majordas or pumpkins and a legume hay such as velvet beans, cowpeas or dolichos beans are essential. The milk supply will begin to decrease. In the case of cows rearing calves it is often good policy in this month to cease milking the cows and to allow the calves to get all the milk from now on. Slightly increase the amount of grain to the dairy cows and increase the proportion of protein concentrate in the dairy cow mixture to make good the usual loss of feeding value in the grass. Bullocks fattening on grass will do better for a daily ration of some succulent feed such as green mealies or sweet potato tops.

Sheep.—Grass seed may be very troublesome. Keep the sheep on short grazing, or, alternatively, put them on to grazing which has been mown. Crutch the ewes due to lamb.

TOBACCO.

All late plants should be topped low to hasten maturity. The bales of cured leaf should be examined to ascertain whether or not the tobacco has been baled in proper condition. Seed heads should receive continued care. Land ploughed during February should be disced and rolled to assist the decomposition of organic matter. Tobacco fields already cleared of plants should be immediately ploughed. Tobacco bulks should be examined and turned, if necessary.

WEATHER.

Rains may be looked for in considerable quantity, though less than in previous months, 5 inches in Mashonaland and 3 inches in Matabeleland being normal, with as usual more on the eastern frontier. No useful rain need be reckoned upon after the end of this month, except on the eastern border, but the rainy season tapers off in an irregular and often erratic manner and without certainty.

SOUTHERN RHODESIA VETERINARY REPORT.

November, 1931.

AFRICAN COAST FEVER.

MELSETTER.—No cases occurred on the infected farm Hillside.

FOOT AND MOUTH DISEASE.

CHIBI DISTRICT.—In the Lundi Reserve, adjoining the Selukwe district, some infection was found in the Shiku and Matenda dipping tank areas amongst herds that had not been infected previously. Dipping has been resumed in this district, and if there are any other herds in a similar position it is hoped that contact at the dipping tanks will result in their contracting the disease at an early date and thus leave no susceptible cattle for the slow perpetuation of infection.

VICTORIA DISTRICT.—Three fresh centres of infection were discovered, viz.: on Townlands Farm, the Chikwanda Native Reserve and the Gomohuru Leper Settlement. On the first-named the disease manifested itself in a severe form, especially in a herd of pure-bred animals in which the loss of condition was very rapid and severe. In Shumba section of the Victoria Reserve infection has been through all kraals, except a few isolated ones in the south-eastern section and some miles from the nearest infection.

CHILIMANZI DISTRICT.—No fresh outbreaks. Infection active on the farm Driefontein, with severe lesions on the feet. In the Chilimanzi Native Reserve there is still some infection in the Rutunga and Janjuri dipping tank areas, where feet lesions have been very pronounced.

GWELO DISTRICT.—No fresh outbreaks. On the previously infected section of Portion of Four Chums, known

as Vigers, the disease was found at some kraals not previously infected.

SELUKWE DISTRICT.—Infection is still active in the Selukwe Native Reserve, but within the cordons. A fresh outbreak occurred on the farm Goli.

BELINGWE DISTRICT.—In the Belingwe Native Reserve north of the Mondi River the disease extended to the northern boundary of the Reserve in the vicinity of the farms Brooklands, Mnene, Mnene Extension and Newcastle, and eventually to the three farms last named. South of the Mondi River infection was located north of the Mwesa Range, and from there it extended northwards along the west bank of the Mondi River to the boundary of the Reserve, and also in the vicinity of Dombe Hill. On the Lou Estate the disease was found in one kraal adjoining the infected farm Newcastle.

BUBI DISTRICT.—Several extensions of infection occurred on Battlefield Block. The disease appeared on the Ntabezinduna Native Reserve, two kraals on the boundary of Battlefield Block being infected. In these areas the form of the disease is very mild and clears up rapidly without any mortality.

GWANDA DISTRICT.—Infection was found around the Siyoka dipping tank on the Tshabezi River and also amongst some cattle on the farm Tygerberg, which had escaped infection when the farm was infected some time ago. The disease also appeared at several kraals on the Msano River, south of Makado Halt. In the Tuli area the following extensions of infection occurred, viz.: (1) at and to the north-west of the Masera dipping tank, (2) ten miles south of the Topore tank east of the Pahzi River, and (3) a solitary kraal west of the Pahzi River within a mile of the Limpopo River. On Liebig's Ranch the only fresh infection was on section 4. A report from the manager of this ranch states that as soon as the rains broke all stock in partially infected mobs on section 9 took the disease very badly and a heavy mortality occurred. In many cases the tongues were swollen to double the normal size and *post mortem* examinations revealed acute septicæmia in the internal organs generally.

SALISBURY AND MAZOE DISTRICTS.—No fresh outbreaks. Disease active in one centre only, viz.: the Arden Ranch.

ANTHRAX.

Two cases occurred in the infected area at Mtoko and the in-contacts were all inoculated.

TRYPANOSOMIASIS.

Three cases reported in Melsetter district.

SCAB.

One fresh outbreak and two flocks under quarantine in Melsetter district.

IMPORTATIONS.

From the Union of South Africa: Horses 5, donkeys 76, sheep 2,230, goats 122.

EXPORTATIONS.

Nil.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA WEATHER BUREAU.

DECEMBER, 1931.

Pressure.—Barometric pressure was generally about normal.

A moderate low appeared on the south-east coast on the 1st and remained there on the 2nd. On the 3rd it had moved off, leaving a weak equatorial low extending into Southern Rhodesia. A succession of movements then took place with

very weak development until the 9th, when the equatorial low again extended to the south-west coast and swung. On the 10th there was a deep low on the south-east coast, which moved inland, covering Southern Rhodesia and the east of the Union on the 11th. This low remained until the 13th, but weakened. Movements were again very weak until the 26th, when the equatorial low again extended to the south coast. Up to the 29th it was weak, but it deepened rapidly, and on the 31st a very strong development covered the whole Union.

High pressure systems were almost entirely absent. A high appeared on the south-east coast on the 6th and was central for two days. The next high appeared on the south coast on the 23rd and was on the south-east coast on the 24th and 25th, becoming central on the 26th and remaining in evidence for three days.

Temperature.—The mean monthly temperature was normal to slightly below normal.

Rain Periods.—Isolated showers fell on the 1st and showers were fairly general on the 2nd and 3rd; showers continued fairly general in Mashonaland up to the 8th. From the 9th to the 15th isolated showers only were recorded, and numerous showers fell in the north from the 16th to the 19th.

Showers were fairly general from the 20th to the 23rd, but were confined to the north on the latter day. Isolated showers fell from the 25th to the 31st.

Rainfall.—The average rainfall during December was 4.4 inches, or about 1.3 inches below normal; it was rather unequally distributed as follows:—

	Rainfall, Dec., 1931.	Per cent. normal.
Zone A	3.5	61
Zone B	2.1	50
Zone C	5.3	87
Zone D	7.7	114
Zone E	4.4	74
Zone F	8.5	104

DECEMBER, 1931.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen ° F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet).
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. ½ Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal.	No. of Days.	
Bulawayo ...	867.7	867.2	91	51	84.2	60.1	72.2	71.7	71.9	62.4	58	56	4.5	1.39	5.2	8	4,436
Gwelo	861.7	...	90	51	82 3	58.7	70 5	71.9	70.5	62.9	66	58	4.9	1.34	6.0	5	4,632
Riverbank ...	...	...	95	54	87.0	61.2	74.1	74.8	73.7	64.7	61	60	...	4.66	5.8	6	4,100
Essexvale ...	...	...	99	53	89.8	62.0	75.9	74.6	71.9	64.1	65	60	...	1.44	5.4	5	3,828
Gwanda ...	909.6	...	97	56	87.8	63.3	75.6	...	76.0	64.0	51	57	3.9	0.83	4.6	5	3,235
Mazunga ...	...	946.6	...	...	...	...	...	78.4	...	...	...	...	...	...	3.7	...	1,970
Nuanetsi ...	...	...	101	56	90.6	63.9	77.3	...	77.1	70.1	71	67	3.1	3.93	3.3	5	1,630
Between Rivers	...	...	87	55	82.1	61.5	71.8	...	70.1	65.3	77	63	6.5	4.94	6.8	18	3,970
Enkeldoorn ...	...	...	86	52	79.8	58.9	69.4	70.7	69.2	62.5	69	59	5.3	3.61	6.5	8	4,720
Gatooma ...	...	...	91	54	86.0	60.8	73.4	74.2	73.2	66.2	69	63	5.9	3.57	7.0	12	3,850
Miami	...	...	85	59	78.3	62.3	70.3	...	69.9	65.3	78	62	...	9.44	5.9	18	4,090
Salisbury ...	854.1	854.4	84	53	78.4	59.8	69.1	69.6	68 8	62.2	69	58	6.7	4.18	6.7	12	4,865
Sinoia, Citrus ...	...	...	...	57	...	62 5	...	...	70.9	65.9	77	63	...	4.73	...	10	3,830
Sipolilo... ...	...	...	84	58	78 2	62.5	70.4	...	70.5	64.8	74	62	6.6	11.59	6.1	20	3,900
Juliasdale ...	...	...	79	44	71.8	54.3	63.1	63.8	65.8	60.5	74	57	...	10.55	8.8	18	6,070
Mtoko	...	...	86	56	79.6	61.7	70.7	...	70.9	64.7	72	61	6.6	7.24	6.6	14	4,210
Shamva ...	...	...	89	60	82 8	64.5	73.7	...	73.8	68.1	74	65	...	11.50	7.0	16	3,170
Angus Ranch ...	...	...	98	60	89.1	67.6	78.4	78.3	77.8	70.1	68	66	...	3.27	4.6	11	2,300
Craigendoran ...	...	...	95	58	87.3	63.5	75.4	...	76.9	68.5	65	64	...	6.19	7.4	9	3,430
New Year's Gift	...	...	96	55	84.2	63.0	73.6	...	73.4	66.8	71	63	...	6.99	5.9	13	2,700
Nyamasanga ...	...	...	84	47	77.5	55.0	66.3	...	68.0	62.4	73	59	...	5.62	...	16	5,080
Riverdene North	...	...	94	52	85.4	60.0	72.7	...	71.8	65.1	70	62	...	3.12	5.0	7	3,700
Stapleford ...	...	...	80	47	71.2	55.4	63 3	...	65.1	60.8	78	58	6.1	12.39	10.8	19	5,450
Umtali	891.8	891.9	89	54	80.2	62.1	71.2	71 9	71.8	65.4	71	62	5.6	6.38	4.8	15	3,677
Victoria ...	894.9	893.8	93	51	84.1	60.5	72.3	73.0	69.3	...	...	...	4.5	0.14	5.2	3	3,570
Melsetter ...	849.6	...	83	52	75.2	57.1	66.2	...	67.6	61.7	71	58	4.2	9.44	7.7	14	5,060
Mount Selinda	...	...	86	55	77.2	61.5	69.4	...	70.1	64.8	75	62	...	9.70	8.9	14	3,520

DEPARTMENTAL BULLETINS.

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Handbook of Tobacco Diseases in Southern Rhodesia, by J. C. F. Hopkins, B.Sc., A.I.C.T.A. Price 3/6 post free from Accountant, Department of Agriculture, Salisbury.

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LIVE STOCK.

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EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Research Work in connection with Foot and Mouth Disease.—The urgent necessity for continuing research into the type of foot and mouth disease prevalent in Southern Rhodesia was emphasised at the Veterinary Conference held in Salisbury in December. At that time the work already carried out by Mr. Bevan and his colleagues in the Veterinary Research Laboratory in Salisbury had established a *prima facie* case for the belief that the disease in Southern Rhodesia differed materially in type from that generally known in Europe. There was no room for doubt that the disease was foot and mouth disease, but its behaviour under laboratory conditions differed in various respects from that which would be anticipated from a study of the work carried out by the Foot and Mouth Research Committee appointed some years ago in Great Britain, and it appeared possible that the type of disease might be such that methods of control far more lenient than those necessary under European conditions

would suffice to prevent the spread of the disease in this Colony and its transmission to other territories by the export of vegetable products, or in fact by any export other than live cattle.

The visiting veterinarians, whilst impressed with the provisional results already obtained, could not reasonably accept this provisional work as conclusive, and urged in the interests of the Colony and of South Africa as a whole that specific investigation be carried out on certain indicated lines. Of these the most urgently important was the definite establishment of the "type" to which the disease belonged.

This work could not be carried out in Southern Rhodesia except at enormous cost and with a great deal of delay, and Mr. Bevan, having succeeded in transmitting the local virus in a viable condition to the research laboratories at Weybridge, has now gone himself to work there in collaboration with Dr. Horner Andrews and other recognised authorities under the ægis of the British Foot and Mouth Disease Commission.

The establishment of the type was the matter of the most immediate importance, but there remain definite investigations as to the behaviour and infectivity of the disease under local conditions—not only in the live animal, but in bone marrow and similar products—and also further investigations into the possibility of its transmission by animals which had recovered from its apparent effects, and also by such products as maize, monkey nuts, etc. Although the preliminary work indicates that these possibilities are small, it is most important that the actual facts should be ascertained by scientific enquiry with the least possible delay, and work in this direction is continuing at the laboratories in Salisbury.

Arrangements have been made for the transfer of a research officer, who will be appointed by the Ministry of Agriculture in England, to the laboratories in Salisbury to continue local investigation in all such directions as may appear to be desirable or necessary.

The ordinary work of the laboratory, and some part at least of the investigations into foot and mouth disease, will continue as heretofore under the charge of Mr. Lawrence.

It is hoped that as foot and mouth disease research work is of vital importance to the whole of South Africa, some contribution towards the cost of this work will be obtained from adjoining States.

Mr. Bevan will bear with him the good wishes of the Colony in the very important work in which he is engaged, and if he should be able to bring it to a successful termination and satisfy our neighbours that considerable relaxations of the embargo may be permitted with safety, his achievement will be a fitting crown to his long and valuable service in Southern Rhodesia.

Enquiry into the Bacon Industry.—Representations are frequently made to this Department in regard to the "unsatisfactory state of the pig industry in this Colony." Many producers are of the opinion that there is unfair competition from the south, and that manufacturing and distribution costs within the trade are too high. To obtain as full information on these points as possible, and to make some statement as to the prospects of the industry, a departmental committee, consisting of Dr. A. E. Romyn, Mr. E. R. Jacklin and Mr. C. A. Murray, has been appointed.

This committee met the Rhodesian and Matabeleland Agricultural Unions, a number of farmers, a number of the more important retailers and wholesale distributors in the trade and inspected the two chief bacon factories during February. The committee met with good feeling on all sides and secured a good deal of useful information. The report of the committee is now being prepared.

Leaf-Curl in Tobacco.—A severe outbreak of leaf-curl occurred on a tobacco farm at Mtepetepa. As the result of a visit by the Plant Pathologist and Tobacco Officer to inspect this farm, the Government decided to ask the Director of the East African Agricultural Research Station, Amani, to allow Dr. H. H. Storey, the Plant Pathologist of that station, to visit Southern Rhodesia to give advice.

For the last ten years Dr. Storey has been paying particular attention to the virus diseases of cultivated crops, and published particulars of a disease in tobacco which it was thought was the same as the disease in this country.

Owing to the difficulty of communication, an aeroplane was sent from Salisbury to convey Dr. Storey from Mbeya, and he arrived on the afternoon of Wednesday, the 20th January.

In company with the Plant Pathologist, Tobacco Officer and Entomologist, Dr. Storey visited some of the more important tobacco areas and Mtepetepa, and his report is published in this issue.

It is felt that the control measures suggested by Dr. Storey will be appreciated by all tobacco growers, and an earnest endeavour should be made to carry them out strictly to letter since they involve nothing but good farming practice.

At the present time the disease is not widespread, but a few individual plants were found to be infected in various centres. These indicate that there is a real danger of the disease spreading and becoming a serious menace to tobacco growing in this country unless immediate steps are taken to check it.

A number of points in regard to both the insect transmitting the disease and the disease itself still remain to be cleared up, but the Department is taking the necessary steps to secure the information required.

Hock Disease in Poultry.—An abnormal condition in poultry known as hock disease or slipped tendon has been investigated by the Agricultural Experiment Station of Pennsylvania. It has been shown that this disease is induced in experimental birds by the addition of excessive amounts of mineral salts to the ration. Bone meal, sodium phosphate, calcium carbonate and the so-called balanced mineral mixtures all caused the abnormal condition in 90 per cent. of the experimental birds. It was found that when protein concentrates are included in the ration no additional minerals

should be added, and that the liberal addition of oats and oat feed produced beneficial properties which cannot be explained on the basis of their fibre content.

Curing Tobacco by Electricity.—An interesting experiment has been made by the State Electricity Commission of Victoria, Australia, using an electrically-heated barn for curing tobacco. A series of tests were made, and the only departure from the ordinary flue-curing method was the substitution of electric heating tubes for the flues and of fans to provide the suitable movement of the air.

The experiment was so encouraging that it has been decided to continue investigations along similar lines whereby it is claimed that the fire risk is reduced to a minimum; there is no possible chance of taint from flue gases; the aroma of the dried leaf is noticeably stronger; the drying can be speeded up without the use of excessive temperatures; regulating thermostats can be employed and the minimum of attention required; loss of quality due to sponging can be eliminated; the colour is brighter and the grade is more uniform.

Report of Empire Sugar Conference.—Sugar production in the Empire from the economic and scientific points of view is reviewed in the report, published in January, 1932, by the Empire Marketing Board, of the Imperial Sugar Cane Research Conference, which was held in London in July, 1930.

India, South Africa, Trinidad, Barbados, British Guiana, Fiji, Mauritius and the Leeward and Windward Islands sent representatives to the Conference, which was opened by Mr. J. H. Thomas, M.P.

The recommendations included the setting up of four central cane breeding and research stations in India, Australia, Mauritius and the West Indies; the establishment of a cane quarantine station in the West Indies; the extension of research on biological control of insect pests; visits to various producing countries by specialists; surveys of the economic position by the Imperial Economic Committee;

investigations into methods of cultivation and labour conditions; and a closer study of the utilisation of sugar bye-products.

Warning: Locusts.—Extensive egg laying by the red-wing locust (*Nomadacris septemfasciata*) has occurred in Northern Rhodesia on the Loanja River, which enters the Zambesi River just north of Kazungula. Four small flying swarms are known to have crossed the Zambesi River near Sesheke into the Caprivi Strip. Extensive hopper swarms of the migratory locust (*Locusta migratoria f. migratorioides*) are also reported from the Kalobo district (Barotse Province).

An invasion of Southern Rhodesia by flying swarms of the red locust may occur at any time, and since it is practically impossible to destroy the adult locusts of this species, the following instructions for the protection of crops are republished for the guidance of farmers:—

The only practicable procedure is for each farmer to attempt to keep these insects from settling on his crops or fruit trees. The experience is that this is considerably more readily achieved in the case of the red-winged locust than in the case of the brown locust.

Most people are aware of primitive methods used by natives and others to keep a threatening swarm of locusts on the move. These include banging of tins, discharge of fire-arms and other methods of creating a noise, together with waving of flags made of bright coloured fabric. The best effect is likely, however, to be obtained by means of smoke smudges.

Materials for producing quick smudge fires and maintaining these for some hours should be collected and kept in position around the lands, with special attention to the side towards the prevailing wind; but other sides should not be neglected. Further material, which on burning gives off a pungent smoke, should be placed in readiness when there is reason to fear a visitation at short notice. Green wood with leaves attached will probably be the most readily available material of this description, but, of course, anything which can be added to render the smoke denser and more foul-smelling is an advantage. In the South African

Union the following formula for a chemical smudge has been recommended:—

Saltpetre	30 parts.
Sulphur	12 parts.
Borax	8 parts.
Coal tar	25 parts.

"The saltpetre, sulphur and borax should be in fine powder or should first be ground; they should be thoroughly mixed and then added to the tar (warmed if necessary) and thoroughly incorporated therewith.

"A deep tin, such as jam or coffee tin, should be filled three-quarters full of the tar mixture, and in the top of this should be placed a layer of about a quarter of an inch deep of priming mixture, of the following composition:—

Saltpetre, sulphur and borax mixture as above ...	2 parts.
Sugar, fine white	1 part.

"In compounding this mixture it is essential that the saltpetre should be thoroughly dry; it is apt to absorb moisture from the air, and should, therefore, be dried in an oven and allowed to cool before mixing. In the centre of the priming composition a small quantity (just a pinch) of chlorate of potash (finely powdered) should be sprinkled, as this will enable the mixture to be ignited without any trouble. A few strings of cordite or gunpowder out of a cartridge could be used for this purpose. As soon as the priming composition is ignited, a lid of some sort can be put over the tin loosely. The priming mixture should burn fiercely, and in about 30 seconds a dense smoke should be produced; an ordinary jam tin, holding 1 lb. of mixture, will burn about 12 minutes. If the mixture starts into flame, a few handfuls of sand should be thrown over it to stifle the flames. There is no likelihood of it being extinguished when once fully ignited. It is of the utmost importance that the priming composition should be thoroughly dry."

It may be stated that tins of material for producing smoke smudges for the purpose of warding off locust swarms can be purchased, ready charged, in the Colony.

THE RAISING OF BACON PIGS.

(Concluded.)

By A. E. Romyn, Senior Animal Husbandry Officer; and C. A. Murray, Lecturer in Animal Husbandry, Matopo School of Agriculture;

With a Veterinary Section by D. A. Lawrence, Veterinary Research Officer.

THE FEED AND MANAGEMENT OF BACONERS.

General.—Guess work should have no place in the feeding of pigs. As much attention should be paid to the balancing of rations for pigs as to those for any other form of live stock. The quantity of feed used should be weighed and apportioned correctly, taking into account the size of the pigs and the degree of finish that they have reached. A weighing scale to determine the progress of fattening of growing pigs is as essential on a pig farm as a milk scale is to the owner of a dairy herd.

The pig is handicapped by the relatively small capacity of its digestive system. It cannot handle large quantities of bulky or fibrous feeds. In general, the ration for baconers should be concentrated and digestible, and the pigs should be pushed for the maximum rate of growth in keeping with the system of management in vogue. As a rule the pigs which make the largest daily gains in live weight are the most profitable to the feeder.

Under local conditions there is no grain feed to equal maize. It is, however, relatively deficient in protein and mineral matter. Rye, barley and oats have the same general characteristics and they can be used interchangeably with maize or as a substitute for part of the maize in the ration.

When used as the sole grain they have less feeding value than maize, and the high fibre content of oats makes that feed unsatisfactory as a sole grain feed for baconers.

The best protein supplements for the common farm grains are separated milk, butter milk and meat or blood meal.* Cow peas, velvet beans, ground nut cake are relatively high in protein, and can be used as substitutes for these animal bye-products. They are generally, however, not quite as satisfactory, nor do they produce bacon of as good a quality. Ground nut cake has a tendency to produce soft bacon, and should not be used extensively for baconers.

Bulky crops such as roots, tubers, melons and pumpkins should only be used in moderate amounts for fattening pigs. Usually not over 3-5 lbs. should be fed per head per day.

The rate of gain will generally be increased by the provision of suitable pasture during the summer months, and by succulent or green feeds during the winter. These green feeds stimulate the appetite of the pig and provide vitamins which may be lacking in the grain ration. To ensure a proper supply of minerals, the pigs should generally have free access to a mixture of bone meal 3 parts, salt 1 part.

Preparation of Feed.—The grinding of maize results in a saving of about 5 per cent. of the feed. In the case of pigs under 150 lbs. live weight, the economy effected is somewhat less. Small grains such as kaffir corn, barley and oats should be ground for pigs. All meals should be fed as a slop. The cooking of the common feeds, except potatoes and beans, decreases their value for pigs. Separated milk should be fed either always sour or always sweet. Usually it is safer to feed it sour. Whey should be fed sweet. Butter milk has of necessity to be fed sour. Cleanliness is especially important with dairy bye-products.

Methods of Feeding.—Pigs may be fed in dry lots or sties or on pasture. The pasture system is little used in Southern Rhodesia. In this Colony the dry lot, or camp, commonly takes the place of the pasture used in other

*There is a wide variation in the protein content of the feeds sold under the general description of "meat meal," and feeders should in all cases secure the composition of the feed before purchase.

temperate countries. The lack of good pastures is unfortunate, as, where suitable pastures are available, pigs will usually make more rapid and more economical gains during the summer by this method than by any other. The dry lot, moreover, unless the camps are frequently changed, is unsatisfactory and frequently becomes a source of worm infection for the pigs. When proper pastures or camps are not available, it is probably advisable to keep the baconers in sties from the time they are weaned until ready for market.

RATIONS.

A. **For Pigs in Sties or Dry Lot.**—Suitable rations are:—

(a) Maize and separated milk or butter milk: The most suitable proportion to feed these in is 1 gallon of milk to every 3-4 lbs. of grain.

(b) Maize and meat or blood meal: The correct proportion of the meat and blood meal will vary from 7-15 per cent. by weight, depending on the protein content of the sample.

Some green or succulent feed should be given with both of these rations.

Cow peas, kaffir beans or velvet beans may be used in place of the protein supplements just named, but in general, better results will be obtained where they form only 20 per cent. of the grain ration and the remaining deficiency of protein is made up by some animal bye-product. A satisfactory farm mixture would be maize 70 lbs., cow peas 25 lbs., meat meal 5 lbs.

In sty feeding the addition of 3-5 per cent. of a cut-up legume hay to any ration which does not contain dairy bye-products will often improve the rate of gain. Barley has a hardening effect on the carcase, and where available at a cheap price can be used with advantage for this purpose.

The pigs should be fed all the grain they can clean up in 15-20 minutes after feeding. The daily quantity consumed should usually be equivalent to about 3 per cent. of the live weight of the pig. A 150 lb. pig should consume 4½ lbs. of grain or its equivalent per day. Plenty of trough room should be provided, and the pigs should be graded into lots

of equal size and strength. Bad doers should be weeded out as they appear, and disposed of to the best advantage.

B. **For Pigs on Pasture.**—On pasture pigs make faster gains in live weight than in sties and require less supplementary protein feed. There is, moreover, a subsidiary advantage, that the pig manure is spread on the land without waste.

The amount of grain to feed to pigs on pasture is determined by the rate of gain in live weight desired and by the nature of the pasture. The heavier the grain ration, the less pasture will be consumed. A daily ration of about 2 lbs. of grain per 100 lbs. live weight will generally preserve a fair balance between the pasture and grain consumptions. Thus pigs weighing 150 lbs. live weight would receive 3 lbs. of grain per day.

The nature of the grain ration will depend on the composition of the pasture and the age of the pigs. The table which follows illustrates the quantity of meat meal (50 per cent. protein) required to balance a maize ration on some typical pastures:—

Pasture crop.	Pigs weighing less than 100 lbs.	Pigs weighing more than 100 lbs.
Kikuyu, paspalum, any young grass	10% meat meal	5% meat meal
Rape, green rye, oats and barley	10% meat meal	5% meat meal
Cow peas, velvet beans and kudzu vine	5% meat meal	None

Instead of 10 per cent. meat meal, 15 per cent. peanut meal or 2-3 parts separated milk by weight can be used.

It may be necessary to "ring" pigs running on valuable grass sod. Water and shade are essential adjuncts to pasture. A clean wallow is an advantage in the hot weather. Adequate fences are necessary, and care should be taken to keep the pastures free from parasitic infection. A mineral lick of 3 bone meal and 1 salt should be provided.

It is not generally advisable to keep baconers on pasture throughout the feeding period, and the pigs should usually be grown out on pasture to a weight of 130-150 lbs., and then

finished in sties or dry lots. This system produces excellent baconers, and the residual stimulating effect of the pasture generally lasts through the finishing period.

Marketing of Pigs.—If possible, the pigs should be got on to dry feed a day or two before marketing. Pigs ship better empty than full, especially in the hot weather, and under ordinary circumstances the morning feed should be withheld on the day of marketing. The pigs should be handled quietly and in the cool of the day if possible. The normal shrinkage in transit to market is 5 per cent. to 10 per cent.

THE FEED AND MANAGEMENT OF THE BREEDING HERD.

Feed for Dry Sows and Gilts.—The feed for dry sows and gilts in the breeding herd should be sufficiently liberal to enable the sow or gilt to farrow in the proper condition and to raise a good litter of pigs. Fat sows produce pigs low in vitality and are clumsy to handle at the time of farrowing, while thin sows cannot nourish the average litter properly. The ration should be well balanced and contain more muscle and bone-forming material than is contained in maize or other grains. As a general guide, mature sows should be fed to gain ½ lb. to 1 lb. daily from the time of breeding to farrowing, and bred gilts, so as to allow for their own growth, somewhat more.

During the summer months pasture is excellent for sows in pig. The range and green feed afforded in this way generally result in large litters and little trouble in farrowing. In the winter months, when pasture is not available, roots or succulent crops or a leafy legume hay should be fed to take the place of pastures.

As the greater part of the development of the embryo pigs takes place during the last six weeks of pregnancy, the ration should be richer in protein—the flesh-forming constituent—during that period than in the earlier stages. The ordinary farm grains, such as maize, wheat, barley, plus a good supply of succulent feed or pasture, will usually be quite sufficient for in-pig sows during the first ten weeks of pregnancy, but during the last six weeks these grains should

be supplemented by a protein rich feed. The normal protein requirements at this period can be met by adding 7-15 per cent. of blood or meat meal (depending on the composition of the sample) or 15 per cent. of peanut cake, or 2-3 parts of separated milk or butter milk—all by weight—to the grain ration in use.

If the pasture is scanty or unattractive, feed the sows on a protein supplement throughout the gestation period, increasing the proportion of the supplement towards the end

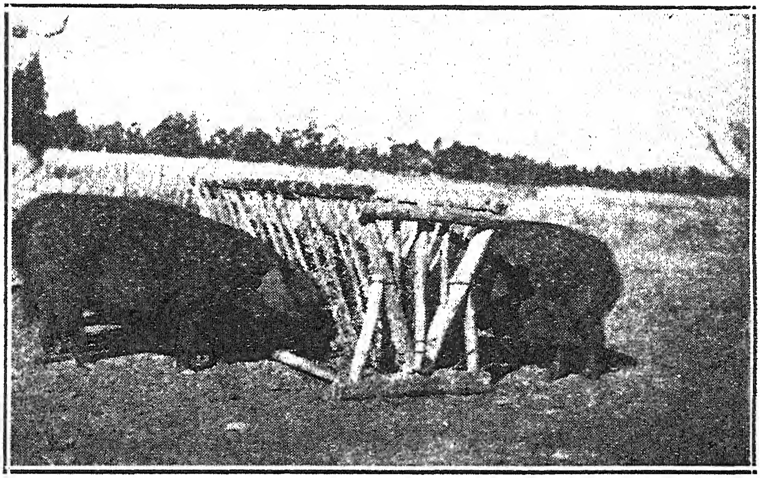


Fig. 6.
Sows feeding on legume hay during the winter.

of the period. Good pastures for sows in pig are kikuyu, paspalum, cow peas, kudzu vine, lucerne, artichokes, etc., as well as any succulent grass.

The quantity of grain to feed per day should be determined by the condition of the sow. In general, however, $\frac{1}{2}$-1 lb. of grain per 100 lbs. live weight per sow for mature sows and $1\frac{1}{2}$ lbs. per 100 lbs. live weight for bred gilts should be sufficient. A typical ration during the winter months for a mature sow would be:—For the first ten weeks, 3-4 lbs. maize meal per day, plus green or succulent feed *ad lib.*, and for the last six weeks of pregnancy, 4-5 lbs. of a mixture of maize 90 per cent., meat meal 10 per cent., plus succulent

feed *ad lib*. During the summer months similar results should be obtained from maize fed at the same rate on good pasture.

Gilts intended for the breeding herd can be fed the same rations as the sows in pig. They should be fed a sufficient amount of grain to ensure good growth and yet not permit them to get too fat. In general this can be effected on a ration of about 2-3 lbs. of grain per day per 100 lbs. live weight, which will usually work out at from 5-7 lbs. of grain per gilt per day.

To ensure that the pigs receive sufficient minerals, they should have free access to a mineral mixture of bone meal 3 parts, salt 1 part. Some breeders add wood ashes or charcoal to this mixture.

Care and Feed of Sow and Litter at Farrowing.—Previous to farrowing, the farrowing pens or quarters should be thoroughly cleaned and disinfected. Unless a movable colony house in clean camps can be provided, the sows should farrow in proper pens with concrete floors, which can be kept clean and free from parasitic infection. As bare concrete floors are cold in winter and often damp in summer, a boarded section of floor on which the sow can farrow is a great advantage. A small quantity of short bedding should be provided, but, as a rule, the less bedding the better. The pen should be provided with a farrowing rail about 9 ins. from the wall and 9 ins. from the ground, to prevent the sow crushing the young pigs.

The sow should be removed to the farrowing pen a few days before it is due to pig. The udder should be washed off once or twice with soap and water to remove worm eggs, and the sow groomed daily, if possible, to accustom it to handling. The ration should be made more laxative. At this time bran and peanut cake are good feeds, as they tend to prevent constipation. A day or two before farrowing, cut the ration down to half.

If the sow farrows normally it should be disturbed as little as possible. Young sows sometimes require assistance, but amateurs often do more harm than good by handling the sow at this time, and experienced assistance should, if possible, be secured if help is needed. After farrowing, the

after-birth and any dead pigs should be removed, and it is advisable to dust out the farrowing pen with slaked lime.

In the case of large litters, the number of surviving piglets should be reduced to ten or less if the sow has fewer teats available.

During the first day after farrowing the sow should be given no feed, but plenty of water to drink. In the cold weather this should be warmed. On the second day 1 lb. of grain should be given as a slop. This quantity should be increased at the rate of about 1 lb. per day to 4 lbs. at the end of the first week. During the second week the grain should be increased at the rate of ½-1 lb. per day until the sow is on full feed.

The ration should be one to stimulate milk production, and the sow should be fed to the limit of its appetite. Sows which are good milkers and which have large litters can with advantage be fed three times a day. If the sows are indifferent milkers they will sometimes commence to put on weight after the fifth week. In this case their ration should be reduced sufficiently to maintain only their weights. Where possible, sows and litters should be fed individually. The common practice of combining several sows in one lot is usually productive of a large percentage of runts among the young pigs.

Good rations at such times are:—

1. Maize 4 parts, peanut cake 1 part, plus a little animal protein, such as meat meal or separated milk.
2. Maize 1 part, separated milk or butter milk 2 parts.
3. Maize 9 parts, meat meal 1 part.

Ground cow peas or kaffir beans can take the place of part of the protein supplements named. Oats, kaffir corn or other farm-grown grain can be substituted for part of the maize. Bran is a valuable feed at this time, and if available can with advantage make up a quarter of the grain ration.

If clean pasture is available, the sow and litter can be turned out to graze when the piglets are two to three weeks of age. If such pasture is not available, the sow and litter

should be kept in a clean sty or farrowing camp until the young pigs are at least three months of age. After that age the effects of parasitic infection are generally not so serious.

Three weeks after farrowing, the milk production of the sow usually reaches the maximum, and provision should be made to supplement the milk after this time. A good way to do this is by providing a grain ration for the young pigs in a creep or enclosure to which the sow cannot get. Shelled maize is a good feed to start the young pigs on; later they can be given some of the same ration as the sow. It is important that the young pigs should be eating grain before weaning. The pigs should be weaned at about eight weeks, depending on the condition of the sow and the quantity and nature of the feeds available for the young pigs after weaning. A few days before young pigs are taken away, the ration of the sow should be cut down and the proportion of protein decreased to reduce the milk supply and lessen the danger of udder trouble after weaning. It is usually more convenient to remove the sow from the young pigs than to reverse the process. Weaning should be completed in one operation, and usually it should not be necessary to return any of the young pigs to the sow. Any abrupt change in the feeding of the weaners should be avoided at this juncture.

When the sow's udder has dried up, the ration should be increased to bring the sow into rapidly improving condition when put to the boar. This plan is based on the practice of "flushing" sheep and is conducive to the production of large litters. The best time to cull unsatisfactory sows is after weaning. All sows which are poor producers, bad tempered, clumsy or pig-eaters should be cut out. No market herd can be kept up to a high standard without constant culling. The minimum breeding standard should be the ability to wean six to eight healthy pigs. One of the most effective ways of reducing the costs of production is to raise large litters per sow.

Shade and Comfort.—During the summer pigs should have plenty of shade. Where natural shade is not available, artificial shelters should be erected. In the hot weather a wallow is of value to keep the pigs cool. A little dip or used motor oil should be poured on the surface occasionally

to preserve it in a sanitary condition. The sleeping quarters should be dry.

In the winter the pigs should be protected from cold winds and draughts. The runs should be arranged so that the pigs can get in the sun when they want to. The sleeping quarters should be kept as free from dust as possible.

VETERINARY SECTION.

Good hygiene is as essential for the maintenance of health amongst pigs as it is for that of all animals. Unless they are kept under hygienic conditions and free from disease, either of an infectious or sporadic nature, they cannot thrive or reproduce to the best advantage. We are fortunate in Rhodesia in not having to contend against diseases such as hog cholera (swine fever), swine plague and swine erysipelas which are so prevalent in many other countries. Even our near neighbours in the Transvaal have with them an African type of swine fever which makes pig raising impossible in certain areas.

The absence of such diseases, however, should not in any way be regarded as a reason for failing to adopt the necessary precautions for preventing introduction of disease into one's swine herd; it should on the contrary serve as a stimulus to prevent and control those diseases which do exist, and to ensure that every effort be made to maintain the animals in perfect health.

There are with us, unfortunately, certain diseases which in far too many cases are responsible for failure in raising or marketing pigs, and it is the intention here to deal only with the most important of these conditions, which are not infectious diseases in the true sense of the term. Before dealing with them, however, it would be well to indicate briefly how to detect any deviation from normal health, and, when such departure is found, what points to pay special attention to in order to obtain information which will assist in arriving at a diagnosis and on which to base curative and preventive treatment.

Most pig breeders are familiar with the normal healthy habits of their stock, relying chiefly on their general appearance and activity, their appetite and the rate of growth or condition as a guide to their state of health.

A normal healthy pig appears alert, the eyes being clear and bright, the skin is clean, and, in young animals especially, has a gloss; notice is taken of any unusual sounds or movements and the animal is active and lively. Mature pigs are considerably less active than young ones, but nevertheless move about readily and are alert if disturbed. At feeding time the animals crowd round and readily—even gluttonously—consume the food when it is given. Young pigs thrive and grow out very quickly on a proper ration, and condition is maintained and increased, the animal appearing well rounded off, the skin evenly and smoothly covering all seats of prominence or depression.

In cases of disease many or all of the above characteristics of the healthy pig, depending on the nature of the disease, are absent. Dulness and listlessness are in evidence in most cases. Movement may be difficult or impossible. The appetite is capricious or may be in abeyance; thirst is increased in most febrile diseases. In diseases which persist for even a few days there is loss of condition and an appearance of general unthriftiness, and if this continues emaciation may become pronounced. In digestive disturbances the act of vomition, or indications of it, may be observed, or there may be signs of diarrhœa or constipation.

In conducting a general examination particular attention should be paid to points such as the above before proceeding to the more detailed special examination.

In observing the symptoms of any disease it is necessary first to examine the animals without disturbing them. This is best done by remaining outside the sty and watching for several minutes—particularly at feeding time. When doing this, particular attention should be paid to the type of breathing of the animal, e.g., whether normal, panting or deep, slow breathing, as this is masked when the pig is disturbed for closer examination.

Having obtained a good general impression of observable symptoms in this way, one should next enter the sty oneself and attempt to make the patient move round, or, preferably, get some one else to do this, and carefully note any peculiarities of movement, reluctance to walk or distress on walking.

One should next proceed to a closer examination of the animal. For such an examination it is necessary to have the patient caught and held securely by one or more assistants, but it is essential that the animal be dealt with carefully and not unnecessarily chased about. This examination includes taking the temperature—the normal varying from about 101 degrees F. in the morning to 103 degrees F., or even a few points more, in the afternoon—observing more closely any abnormalities already detected, e.g., any swellings or discharges, and noting any other points likely to assist in diagnosis, e.g., the state of the breath and the colour of the mucous membrane of the eye and mouth.

Should an animal die a *post-mortem* examination should be made, unless there is any suspicion that the disease may be anthrax, in which case the carcase should on no account be opened, but a blood smear made, care being taken that as little blood as possible escapes from the incision, and veterinary advice immediately sought. When a large number of pigs are suffering from any disease it is advisable to slaughter one and carry out a *post-mortem* examination with a view to arriving at a definite diagnosis, and hence being able to institute effective treatment for the others.

A *post-mortem* examination to be of any use must be thorough and must be performed as soon after death as possible; this is particularly important, as putrefaction sets in very rapidly and masks any changes in the organs which might otherwise have been detected. In order to be able to observe any deviations from the normal it is necessary to have a good idea of the general appearance of organs of healthy pigs, and one is therefore well advised when slaughtering pigs for consumption to spend some time in studying the appearance of such organs as the lungs, heart, liver, spleen, kidneys, stomach and intestines. Being familiar with the normal fits one much better for distinguishing disease changes when these are encountered.

A *post-mortem* examination is not complete unless all the above-mentioned organs are examined, and, in the case of the stomach and intestines, these should be opened with a pair of scissors throughout their entire length. Many deaths are attributed to mysterious diseases when the owner himself, by opening the stomach and intestines, could easily

have found the true cause in the shape of masses of round worms (*Ascaris*).

To adopt preventive or curative treatment without being able to diagnose the trouble is a most unsatisfactory, useless or even harmful procedure, and it is for this reason that some time has been spent on describing the essentials of clinical and *post-mortem* examination.

Measles (*Cysticercosis*).—The infestation of pigs with measles undoubtedly is responsible for the greatest number of carcases which are condemned as unfit for human consumption.

A measle (*Cysticurcus cellulosæ*) is the cystic, bladder worm or development stage of the human tape worm (*Tænia solium*). The pig is therefore the secondary host, harbouring only the immature stage, of an intestinal parasite of man, who is the primary host.

The life cycle is passed through in the following manner. Starting from the adult tape worm in the human intestine, eggs are produced and pass from the worm into the contents of the bowel, and are voided in the excreta. Such contaminated excreta may then be eaten by a pig, in which case the infective eggs on arrival in the stomach are acted upon by the gastric juices, the shell is dissolved and a minute parasite liberated. This embryo perforates the stomach wall, and, by migration into and transportation by the blood stream, arrives in the muscular system, where it undergoes further development, changing from the young embryo to a bladder worm (measle) stage. When fully developed and mature this is infective to man, and if the infested pig is slaughtered and the flesh containing the cysts eaten it develops further, becoming a tape worm located in the intestine. This matures and in turn develops eggs, and the life cycle is repeated.

The cyst may first be visible to the naked eye three weeks after becoming seated in the muscle. At this stage, however, it is easily missed. With development it enlarges, varying in size up to that of a small pea. It has a bladder-like appearance, light blue in colour and transparent with a white spot inside, which is the head of the future tape worm. The cysts are mature, i.e., fully developed and

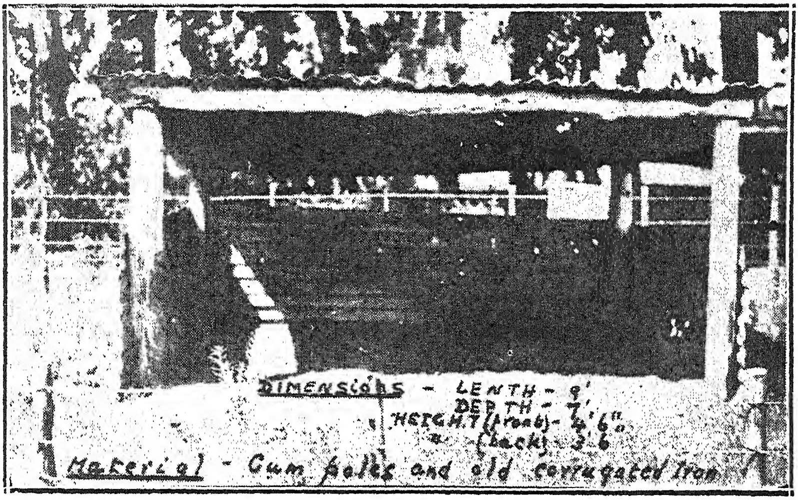


Fig. 7.
A simple colony house.

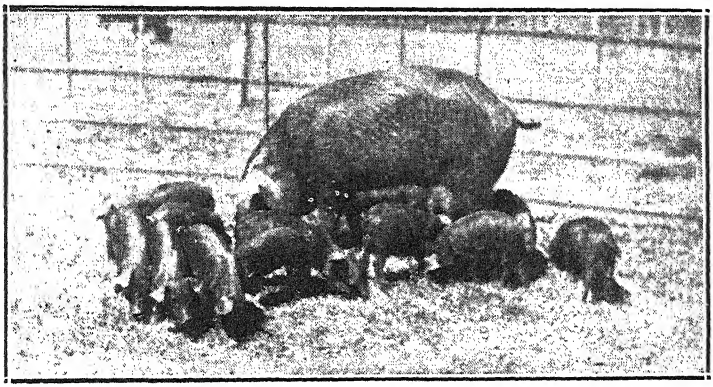


Fig. 8.
A good producer.

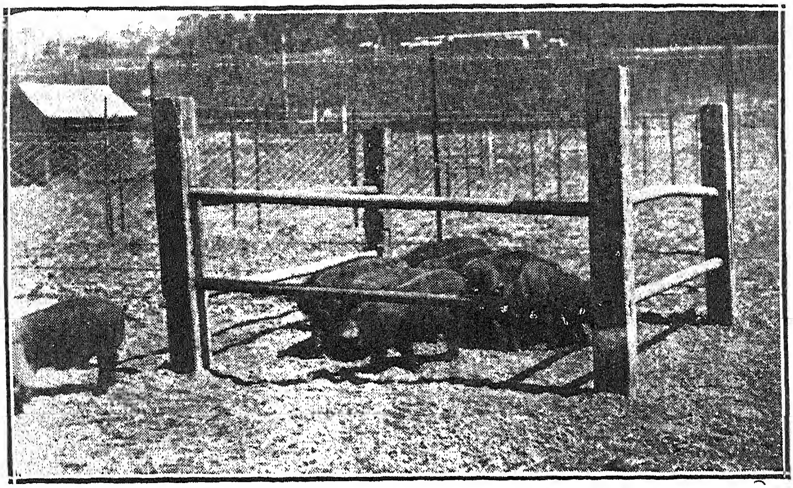


Fig. 9.
Young pigs feeding in a creep.

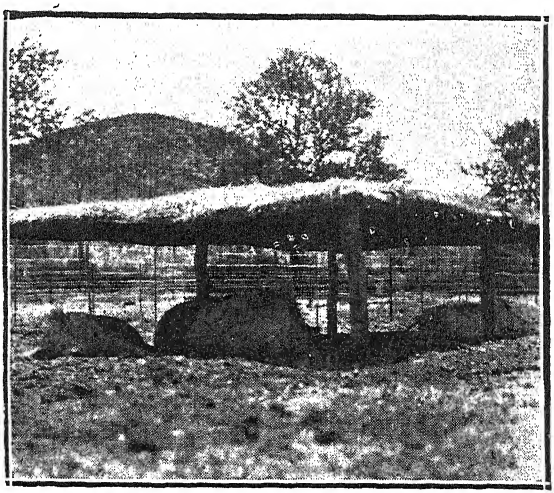


Fig. 10.
Artificial shade.

infective, after three to four months' development. Sometimes even before this stage, or at a variable later period, they degenerate, becoming opaque and hard, in which case they are no longer infective.

No symptoms are observable in the living pig. Infection is only diagnosed when the muscles are cut open after death, with the exception of those rare cases in which the measle cysts are visible on the under surface of the tongue. The parts in which the cysts most commonly occur are the muscles of the tongue, neck, thigh, forearm, heart, diaphragm and cheek.

There is no method of destroying measles in a live pig. Treatment therefore being useless, preventive measures are all that remain. Fortunately, owing to the knowledge of the life history of the parasite, these are simple and completely effective, and consist of preventing pigs from eating infected human fæces, or food contaminated with such. Infected humans should be put under curative treatment, and the use of latrines be encouraged, and finally, infected carcases of pigs should be destroyed to prevent further infection of man.

Ascaris Suum.—This is the most harmful worm parasite of pigs. Its habitat is the small intestine, and in this position sometimes hundreds may be found. It is a large worm, light cream in colour, five to eight inches long and about the thickness of a clinical thermometer or its case. No intermediate or secondary host is required for the life cycle. Eggs laid by the female parasite in the intestine pass out with the fæces, and under favourable conditions of warmth and moisture the embryos, still in the shell, develop on the ground to an infective stage in ten to fourteen days. Such eggs are very resistant to unfavourable influences, such as frost, drying and even ordinary disinfection, being stated to remain infective for up to five years or more. Such a ripe egg when ingested by a pig is acted upon by the gastric juices, and the larva is liberated in the stomach. The larva now bores its way into a blood vessel, and is carried to the liver, and thence to the lungs, where further development occurs. From here it passes into the bronchi, up the wind pipe, is coughed out through the larynx, swallowed and passes again into the stomach and into the intestine, where

it matures. The period of migration occupies about ten to twelve days.

The symptoms are variable on account of the complex development of the parasite. Their presence in the lungs frequently causes pneumonia in young pigs, the symptoms then being dulness, loss of appetite, difficult breathing and a cough. Death may result from a severe lung infection in one to two days. Where infection is less severe the young pigs are stunted and unthrifty, and show symptoms of coughing and difficult breathing. The cough may improve, and the only persistent symptoms are those of unthriftiness and distressed breathing (snuffles). Weaners may show the above symptoms, but usually the symptoms are more indefinite, the animals being stunted, pot-bellied and weak in spite of good food. Sometimes convulsive fits occur at feeding time. Symptoms are most pronounced in young pigs; adults may show a slight cough and lose condition. *Post-mortem* appearances depend on the symptoms noticed, e.g., pneumonia, when the young pigs die as a result of acute infection. Where the disease has persisted for a fortnight or so the mature worms are found in the intestine, and here there may be noticeable ulcers and hæmorrhages.

Treatment is only recommended in conjunction with prevention. It is no use allowing treated animals to remain on infected ground, especially when it is realised that the ripe eggs are so resistant. It consists of starving the animal for 24 hours and then drenching it with chenopodium oil and castor oil at the rate of 1 c.c. of the former and 8 c.c. of the latter for every 25 lbs. body weight. These drugs may be given in a little bran or mealie mash, but are then less reliable. The pigs may be fed as soon as the purgative has acted.

Prevention varies according to circumstances. Where infection does not already exist care should be taken to prevent its introduction, e.g., by procuring pigs from a known clean area, or, if any doubt exists, even these should first be freed from all infection by treating as above.

On infected farms the pigs may be moved to an area previously kept free, taking precautions to treat them before removal. If this is impracticable, a sow should be thoroughly scrubbed and washed immediately before farrowing to clean

her skin of eggs which may be present in the adhering dirt. She should be placed in a farrowing pen which has been previously cleaned with boiling water and caustic soda. Within ten days after farrowing the sow and her litter should be removed to a clean field planted with some suitable crop, the sow being removed after the young are weaned, and the weaners remaining there to grow up in safety. This method has been found to give excellent results whenever practised.

Scours (Diarrhœa).—One of the most common conditions causing serious losses in sucklings is scours. The cause can usually be traced to unsanitary conditions, wrong feeding or intestinal parasites. The feeding of the sow on mouldy or fermented foods, excessive maize, at irregular periods or suddenly changing her diet are frequently responsible for scours of sucklings. Diseases of the udder or infectious diseases of the sow are also manifested as scours in her litter. The symptoms are obvious. The fæces are fluid or pasty, frequently voided, light coloured and foul smelling, and the tail and hindquarters are soiled. Death may occur early or the disease may persist with marked loss of condition.

In weaned and older pigs the condition is also due to similar causes, bad and wrong food being the usual, if infectious disease and parasitism are excluded.

Treatment consists of removing the cause, i.e., the food, and hygiene should be immediately corrected. A purgative, castor oil, should be administered with a view to eliminating the irritating substance; in the case of sucklings the sow should receive the treatment. If the condition still persists, lime water given with the food in doses of 5 to 10 ozs. is said to be effective. Should parasites be responsible, the animals should be treated as recommended for ascaris infection.

Constipation.—This is usually the result of too concentrated foods, especially in conjunction with limited exercise. The food should therefore be corrected and provision made for sufficient exercise.

If the condition is acute an enema should be given. Purgatives, such as castor oil, linseed oil, or epsom salts, are also useful.

Pregnant sows should be allowed 3 ozs. of linseed oil daily in their slop feed as a preventive.

LEAF CURL OF TOBACCO IN SOUTHERN RHODESIA.

Report by Dr. H. H. Storey, Agricultural Research Station, Amani.

General Considerations.—The disease which is known in Southern Rhodesia as "leaf curl" is not a new one. Mr. Hopkins agrees with me that it is identical with that which he described as "crinkling" and farmers generally know as "Frenching" (but not the true "Frenching," which is a different disease). It has been of sporadic occurrence for a number of years.

The disease has caused alarm during the present season, owing to a small number of severe outbreaks. Although individual losses have been serious, I judge from the information given to me that the loss from this cause in the aggregate is likely to be small this season. The danger lies in future developments.

Seasonal fluctuations of the intensity of outbreaks are certain to occur, and it is possible that the present outbreak is of this nature. On general grounds and upon the analogy with the similar disease of cotton in the Sudan, I consider that, if left unchecked, the disease is likely to show an increasing severity of outbreaks in the future. I do not suggest that future prospects are alarming; but I urge that the control measures, which are the best that can be recommended in our present state of knowledge, should be carried out thoroughly by all farmers.

A diseased plant represents a total loss; if severe outbreaks become general, the aggregate loss to the industry would be serious.

The Nature of the Disease.—My examination of the plants in the field in Southern Rhodesia leaves little doubt

in my mind that the disease in this country is identical with that which I have studied at the East African Agricultural Research Station, Amani. My investigations there have shown that it belongs to the group of virus diseases caused by an invisible agent of unknown nature. The virus is naturally transmitted from plant to plant by a species of white fly (*Aleurodidæ*). The part played by the insect is that of transferring the virus from a diseased plant to a healthy one; in the absence of diseased plants the insect cannot produce the disease. Unlike the mosaic virus, the virus of leaf curl is not readily transferred mechanically, e.g., by handling plants. It is highly improbable that it persists in the soil or in the debris of tobacco plants.

During my visits to farms in the neighbourhood of Salisbury, white fly—probably of the same species as those in Amani—were found in all fields where leaf curl was present. There is, therefore, no reason to doubt its association with the disease in Southern Rhodesia. Experiments have been started, however, in collaboration with Mr. Hopkins to prove this association.

Although leaf curling is a manifestation of this disease, this feature is highly variable in different varieties and under different conditions. Curling may be caused by many agencies—aphid infestation, the inherited abnormality known in the Union as "Curly Leaf," etc. The important feature for diagnosis is the greening and thickening of the smaller veins on the lower surface of the leaf. This is most readily seen if the leaf be viewed against the sky. Occasionally an extreme form of this vein thickening is seen in the form of leafy outgrowths. If there is no greening of the veins, it must be regarded as doubtful whether the true leaf curl disease is present.

Control.—Once a plant is affected by this disease there is no possibility of its cure. The virus is distributed throughout its tissues, and all new growth will be affected. There is no known method of destroying the virus once in the plant without killing the plant itself.

Control measures can only be directed towards the prevention of infection. It will be clear from the earlier part of my report that the virus can exist only in diseased plants

or in white flies. If either of these links can be broken, the virus cannot continue to do harm.

The control of the white fly is an entomological problem. But I think I am correct in interpreting the views of entomologists in saying that no practical method is known for the control of white fly in tobacco fields.

I consider it to be possible that a study of the life history of the white fly might show some means for lessening infestation. In particular, I would suggest that consideration should be given to means for reducing possible infestations in seed beds.

The most hopeful method of control lies in the removal of the source whence the white fly obtains the virus.

It is almost certain that the virus is carried over the winter in some plants. It is possible that it survives in certain weed plants. One weed is known to harbour the virus in the Amani district. I was unable to find that species in the Salisbury district, or any other species which showed definite signs of being infected by this virus. While, therefore, the question whether alternate host plants of the virus occur in Southern Rhodesia must remain unanswered for the present, the possibility of their playing a part in the maintenance of the virus must not be overlooked.

There is, however, one certain means whereby the virus is carried over the winter. It is in surviving plants of tobacco in the previous season's lands. There is every probability that a large proportion of such plants will be affected by this disease. From them white fly carrying the virus of leaf curl will be disseminated in spring to the newly planted fields.

I regard therefore as the most important step for the control of the disease the thorough cleaning up of all tobacco lands as early as possible after the crop has been reaped. The earlier the old tobacco plants are destroyed and the longer the winter period during which there are no tobacco plants on the lands the more likely is successful control. Every farmer should make a point that no single tobacco plant survives through the winter upon his farm, in his native lands or garden. I cannot stress too strongly the serious effect which even a few ratooning tobacco plants

may have in the dissemination of this disease to the new crop.

An additional precaution which should be taken is the removal from the fields as early as possible of all plants which develop the disease during the growing season. These plants should be burnt or buried at once.

There is one other method of control which I consider should be exploited as an insurance against serious outbreaks in the future. This is the breeding of resistant strains of tobacco. It is necessarily work from which results cannot be expected for a number of years.

The selection for resistance can only be done in a region where heavy infection by this disease may be expected annually. At present there is no such region in Southern Rhodesia. I can, however, be fairly certain of heavy infection in my plots at Amani. I am, therefore, prepared, if my Director agrees, to undertake at Amani the preliminary selection. I would ask that I may be supplied with seed of all the tobacco varieties available in Southern Rhodesia. I will then endeavour to carry out pure line selections for resistance over two seasons, and then hand over the selected lines to your Department for trial and possible further selection.

Summary.—My views may be summarised as follows: The complete removal of all tobacco plants from the entire farm after the season's crop is harvested is likely to give satisfactory control of the disease. It is certain to reduce infection materially, but I realise that it may fail to give full control should there exist alternate host plants of which we are at present ignorant. I therefore recommend that the possibility of alternate host plants be investigated, and that the breeding of resistant strains of tobacco be carried out, if this be practicable, as a safeguard against a possible future breakdown of the direct control measures recommended.

TECHNICAL CONSIDERATIONS.

Nomenclature.—The name "leaf curl" appears to have been adopted in Southern Rhodesia, and I have consequently employed it in my report. It is doubtful whether it is well suited to this disease. In the Union this disease is known

as "crinkly dwarf." "Curly leaf" or "leaf curl" is there used for the inherited abnormality. Probably the same virus disease is known in Nyasaland as "cabbaging." A disease of very similar manifestation is known in Java as "kroepoek." Another disease is known in Java as "krulziekte" (usually translated into English as "leaf curl"), but it is uncertain whether this is identical with "kroepoek."

"Frenching" is obviously an unsuitable name.

I would favour a name which bore some reference to the enations, the most characteristic symptom of the disease. However, Dr. Butler recommends "leaf curl," which is the name now accepted for the analogous disease in cotton.

Symptom Expression.—The symptoms of the disease are extremely variable and render diagnosis often very difficult. I hope I am correct in regarding the enations (i.e., including under this term the simple greening of the veins) as the important diagnostic feature. I argue that they are an unusual form of plant abnormality; that, whereas curling of the leaves may have many causes, it is unlikely that the enations can have more than one cause. It is primarily on this basis that I diagnose the disease seen in Orinoco White Stem as identical with the Amani disease. I may say, however, that certain varieties in my plots at Amani have exceptionally developed a downward curling and savoying similar to that seen in Orinoco White Stem.

Although I regard the enations as necessary for diagnosis, I have had experimental plants, undoubtedly infected by this virus, which showed only mild curling without greening of the veins. It is probable that a close acquaintance with the disease in a particular variety may allow one to diagnose early cases without the enations.

The clearing of the veins is a character which I do not yet understand. In my transmission experiments it was usually transitory, and quickly disappeared. In my plots, however, I have rarely seen plants which retained this character in the pronounced form which I saw in the field occasionally near Salisbury.

Variation in Severity.—This is one of the most perplexing features of the disease. I am not clear as to the explanation. It is one of the points upon which I hope to obtain evidence in my future work at Amani. I suspect that variations in the individual reactions of the plant may play a part. I also suspect that there may be a number of strains of the virus of varying virulence. Hitherto in my experiments in transmission my plants have developed the disease only mildly, except in the instance of plants which were kept unprotected in the open through the winter, which produced very severely affected suckers.

Transmission Experiments.—I have produced this disease by feeding white fly, collected upon diseased tobacco, upon healthy seedlings. I have failed to produce any disease symptoms in seedlings fed upon by white fly bred upon healthy bean plants. I have not yet transmitted the disease with white fly bred on healthy plants and later fed upon diseased tobacco, owing to the difficulty which I have encountered in maintaining white fly on tobacco under artificial conditions. I have no reason to suppose that this experiment would not succeed.

In these experiments I have found it necessary to cage considerable numbers of white fly in lamp glasses covering the whole plants. The method of pressing a leaf against the open end of a glass tube has not been successful.

The symptoms produced in the experimental plants have been a transitory clearing of the veins of young leaves, a mild curling characteristic of the variety under my conditions, the greening of some of the veins and a stunting of the plants. This manifestation has been typical of the mild form of the disease in the field at Amani.

Alternate Hosts.—In the Amani district a composite weed, *Vernonia* sp., frequently shows enations on the veins similar to those in tobacco. I have successfully transferred the disease from *Vernonia* to tobacco by white fly bred on healthy bean plants. I propose to continue a search for alternate hosts of the virus, and will communicate to your Department any results that I may obtain.

In view of this finding, the species of *Vernonia* which occur in Southern Rhodesia are to be regarded with suspicion

as possible hosts of this virus. I recommend that officers of your Department pay particular attention to this genus. At the same time I recognise that alternate hosts may be found in any family. It would be advisable that your officers maintain a lookout for any wild plant showing enations of the type which characterise this disease in tobacco.

The White Fly Vector.—The species used in my experiment has been determined by Dozier as *Bemisia* sp. Kirkpatrick considers that it is probably identical with the *Bemisia gossypiperda* which transmits leaf curl of cotton.

It will be obvious to you that we are working on very uncertain grounds while we remain largely ignorant as at present of the life history of this species. In particular I consider that information is needed upon the over-wintering of the insect. If it should be found that pupæ may hibernate, it is likely that many would survive the winter attached to debris of diseased tobacco plants. Upon hatching in the spring, these individuals would probably be infective.

I recommend that this very important point should be investigated by your entomologists. If hibernation should be found to occur in this manner, the mere removal of the old plants after harvesting might prove to be insufficient to secure control. Efforts would need to be directed to the complete destruction of all tobacco debris.

A RECORD OF WHEAT FERTILISER AND VARIETY TRIALS

ON THE GOVERNMENT RESEARCH FARM, MARANDELLAS.

By T. K. Sansom, B.Sc., Plant Breeder.

A series of wheat fertiliser and variety experiments were commenced by the writer in the winter of 1931 on the above farm. The land selected was typical of the better vlei soils of the district, and had been once ploughed in the winter of 1930 and then left fallow until early in 1931, when it was levelled and laid out in the requisite number of plots.

Wheat Fertiliser Experiments.—Before undertaking extensive fertiliser trials, it was considered necessary first to learn something about the moisture-retaining character of the land on which it was proposed to grow wheat for a number of years, and for that reason the experiments here recorded were designed to take the form more of a demonstration than a scientific enquiry. The results from the first season were intended to be used as a guide for future experiments, but unfortunately the operations on this farm were closed down towards the end of 1931, with the result that plans for the following season have had to be abandoned.

It is not possible to draw any definite conclusions from the experience of only one season, and the results obtained can only, therefore, serve to indicate the fertiliser or fertilisers which may be found suitable under similar soil conditions.

One acre of land was selected and divided into fortieth-acre plots, ten different treatments being adopted, with four replications of each. The plots were randomised, so as to overcome as far as possible differences of fertility and soil moisture.

The treatments per acre were as follows:—

"A" plots: No fertiliser.
"B" plots: 1,000 lbs. lime.
"C" plots: 2,000 lbs. lime.
"D" plots: 4,000 lbs. lime.
"E" plots: 200 lbs. bone and superphosphate, plus 50 lbs. muriate of potash.
"F" plots: 200 lbs. Rhodesian wheat fertiliser (complete: N. P. and K.).
"G" plots: 200 lbs. bone and superphosphate (1-3rd bone and 2-3rds supers.).
"H" plots: 2,000 lbs. lime, plus 200 lbs. Rhodesian wheat fertiliser.
"J" plots: 2,000 lbs. lime, plus 200 lbs. bone and superphosphate.
"K" plots: 2,000 lbs. lime, plus 200 lbs. bone and superphosphate, plus 50 lbs. muriate of potash.

It will be noticed that there are four series of treatments, namely, those receiving no fertiliser, those receiving different applications of lime per acre, those receiving different forms of fertiliser and those receiving a basic dressing of lime, together with the same fertilisers as in the third series.

The plots were sown on the 10th of May to Karachi wheat and all had germinated by the 16th May. Within the first ten days after germination, a very noticeable difference could be seen between the different series of treatments. The unfertilised plots presented a sickly yellow appearance, and to a lesser degree so did the plots receiving lime only. There was no apparent difference among the remaining plots until flowering time, but after this it was observed that the wheat on the plots receiving both lime and fertiliser bore larger and heavier ears.

The "A" plots yielded nothing—in fact, the plants grew to a height of not more than three inches and then died off. "B," "C" and "D" plots (lime only) likewise yielded nothing, and although the growth of the plants was a little better here, there was no apparent difference between the growth on the plots receiving the lowest and highest applications of lime. The table below gives the yield in lbs. of grain per acre for the different treatments:—

Plot series.	Average yield per acre of four plots.
"A" (no treatment)	Nil
"B" (1,000 lbs. lime per acre)	Nil
"C" (2,000 lbs. lime per acre)	Nil
"D" (4,000 lbs. lime per acre)	Nil
"E" (200 lbs. bone and supers., plus 50 lbs. muriate of potash)	214 lbs.
"F" (200 lbs. Rhodesian wheat fertiliser)	201 lbs.
"G" (200 lbs. bone and supers.)	193 lbs.
"H" (2,000 lbs. lime, plus 200 lbs. Rhodesian wheat fertiliser)	617 lbs.
"J" (2,000 lbs. lime, plus 200 lbs. bone and supers. per acre)	553 lbs.
"K" (2,000 lbs. lime, plus 200 lbs. bone and supers., plus 50 lbs. muriate of potash)	714 lbs.

In no instance are any of the yields good, the average from the "K" plots being the best with a mean yield of a little over 3½ bags per acre. It must be borne in mind, however, that the land was very raw, having only been roughly broken the previous season and having received no further preparation until just before sowing, owing to pressure of other work; during December and January it was lying under water to a depth of one inch or more in places. Lime was not applied until April, and had, therefore, very little time to become effective.

It is of interest, however, to note that those plots receiving lime in addition to fertiliser were definitely superior to all others. Unfortunately, it is not now possible to determine whether wheat on the limed plots would have further responded to this treatment in subsequent seasons.

Wheat Variety Trials.—These trials were conducted on a similar piece of land. A basic dressing of 2,000 lbs. of lime, plus 200 lbs. of Rhodesian wheat fertiliser, was applied per acre, and 57 varieties collected from various sources in Rhodesia and elsewhere were sown.

At harvest it was found that about 60 per cent. of the varieties had set grain, the remainder being blind; this must be regarded as satisfactory, especially in view of the fact that the writer was assured by several farmers in the district

that not a single grain of wheat would be reaped owing to blindness.

It was also fortunate that, on the whole, varieties which are generally recognised to be the better wheats for the Colony were those to set grain, and further selections could thus be made from these.

Of the varieties which showed most promise, Kenya Governor, Karachi, Pusa 52A, H.G.M.T2, Quality, Reward Ottawa, Garnet Ottawa, Droop 3 and Cawnpore were the best.

Date of Seeding Trials.—This experiment was designed to obtain information with regard to the optimum date of seeding wheat on the vlei lands of the sand veld. The following seven varieties of wheat—Kenya Governor, Karachi, Quality, Mentana, B.286, AES.5 and Klein Koren—were seeded at weekly intervals from the 1st May to the 26th June.

There was a distinct gradation from the earliest to the last sowings—in fact, the three last sowings (12th, 19th and 26th June) gave no yield whatever; in the other sowings the yield became progressively less the later the wheat was sown.

Of the above seven varieties tried, Mentana and AES.5 gave no yield whatever.

Conclusion.—It must again be emphasised that none of the results can be regarded as conclusive, as it is impossible to make recommendations on the work of one season only.

However, it does appear fairly obvious that on vleis typical of that on the Government Farm, Marandellas, the growing of wheat is not a commercial proposition until some form of fertiliser be applied, and also that the earlier the date of seeding takes place—within reason—the higher will be the yield, which, after all, is only to be expected. The advisability of wheat farmers testing the effect of dressings of three-quarters to one ton of lime per acre, in addition to farm manure or artificial fertilisers, is also indicated.

THE LESSER TOBACCO WIREWORMS.

By Rupert W. Jack, F.E.S., Chief Entomologist.

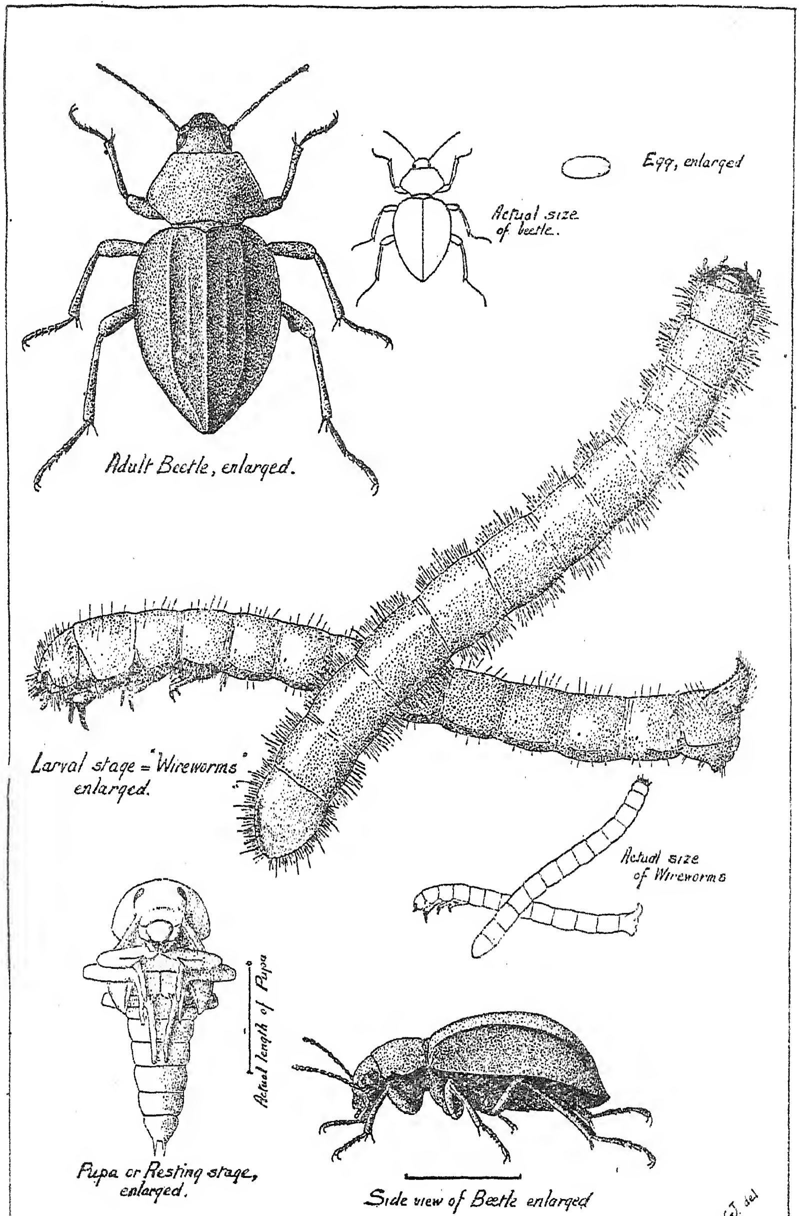
The most injurious of the so-called "wireworms" which attack tobacco, cotton and other crops in Southern Rhodesia belong to the genus *Trachynotus* (fam. *Tenebrionidæ*).

Effective control depends in the first place on the grower's ability to recognise the pest when it appears as a beetle from March to May. Prompt measures are necessary to destroy the beetles before egg laying has proceeded very far. It is hoped that the accompanying plate will be of assistance in this connection.

The reader should note that the actual size of the beetles and of the wireworms themselves is shown by the smaller outline figures adjacent to the larger shaded figures. The colour of the beetles is dull black, but they have a slight brownish or greyish appearance, due to the short hairs which clothe them. They are also frequently more or less covered with dust. In size and even shape they are variable within limits, the smallest specimen in the collection measuring only seven-sixteenths of an inch in length and the largest nearly eleven-sixteenths. It is not quite certain how many species are involved in injury, but the species figured, which has been determined as *T. geniculatus*, Haag., shows one common form.

The beetles live solely on the surface of the soil and are incapable of flight. They commonly congregate under shelter during the day and move about in a lively manner when disturbed.

The time of their appearance seems to vary considerably from year to year, and no doubt also with locality. Odd specimens have been seen as early as March, but as a rule they appear in numbers during April, and in the breeding cages at the Agricultural Laboratories a number have not



Trachynotus.

emerged until May. They should be looked for from the beginning of April, and when they show up in numbers, baits should be applied at once.

The life history of the insect, as far as it has been elucidated, is as follows:—The adult beetles commence to lay eggs shortly after emergence from the soil, and continue to do so for some weeks. Eggs have been obtained in large numbers at Salisbury during the last week in April and the first half of May, a fact which illustrates the necessity of prompt action as soon as the beetles are present in numbers. The eggs are laid in the soil. They are small glistening white objects which lie loosely in the soil without adhering to the particles, and are commonly to be found at a depth of about a quarter of an inch frequently under some shelter such as dead leaves, grass, etc., where the beetles congregate. The eggs take apparently a month or more to hatch, which results in the young wireworm finding a very dry environment when it appears. It grows, however, comparatively rapidly during the winter, and by the time the next rains arrive, may have reached a length of an inch or more, which is about the length of the common species when it attacks the newly planted tobacco. Growth continues during the wet season, and the change to the pupa or resting stage commonly takes place in March. The pupa rests in a very flimsy earthen cell in the soil. The pupa stage lasts about three weeks, but the beetles do not apparently always come to the surface immediately they have emerged from the pupal skin and hardened. The life cycle thus may take one year, but a proportion of the grubs may remain over another year in a practically full-grown condition and not produce adults, therefore, until the second year. This fact constitutes something of a complication in regard to control measures, as it is clear that poisoning the adults one year will not necessarily free the land of all the wireworms of this genus by the next year. Breedings carried out at Salisbury have so far indicated that the one year cycle is the rule, but the question certainly requires further investigation.

The food of the wireworms during the dry season probably consists of the underground portions of plants and possibly of dry vegetable matter, but they may be to some

extent carnivorous. Certainly they injure each other very freely if at all crowded in confinement.

Their injury to tobacco and other crops in the early part of the rains shows, however, that they have a great liking for green plant tissue at that time. In confinement they have usually been fed throughout on sliced potatoes and similar foods.

Injury to tobacco usually consists in the wireworms eating into the underground stem, with the result that the plant promptly wilts. Similar damage has been reported in reference to *cotton*. The wireworms also commonly attack the germinating seed of *maize*, in this case not causing immediate wilting of the plant, but none the less assuring its practical failure. Cotton is sometimes heavily infested, the germinating seed and very young plants being eaten by the wireworms.

CONTROL MEASURES.

Whilst experiments have been carried out with a view to finding some means of destroying the grubs in the soil, they have not yet given sufficiently encouraging results to justify recommendations as to procedure along these lines.

Similarly, experiments to date have not yielded results justifying recommendations concerning the use of repellents which might be mixed with the soil at the time of planting. A repellent would probably need to retain its action for a considerable period to be of much value, but it is hoped that something useful in this connection will be found in the not too distant future.

It is in the adult or beetle stage that this pest appears most vulnerable.

In the first place the beetles like shelter, and observations in the field indicate that they tend to leave land which is smooth and bare. New land may, therefore, be broken during the previous wet season, and if thoroughly cleaned up and bare by April, should be less liable to contain wireworms in quantity when planted next season. It may be possible in some cases to follow the same procedure with certain old lands which are known to be infested with the pest. Clean cultivation tends to assist against this pest as against many others.

Owing to their liking for close shelter, the beetles can be concentrated in a large degree by distributing small heaps of grass or brush about otherwise clean land, and under these circumstances a large number could no doubt be destroyed mechanically by "boys" armed with flails of baling wire or similar weapons.

The beetles are, however, readily destroyed by means of poisoned bait, and in view of the fact that the available labour on a tobacco farm is usually thoroughly occupied in April and early May, bait, which requires much less labour, is no doubt preferable to hand methods.

The following formulæ have given good results. Maize bran moistened to a stiff dough with a solution of 1 lb. arsenite of soda in 20 gallons of water is the cheapest. A tablespoonful to each 10 square yards may be tried in badly infested parts of the field, but the most economical rate of distribution is still in doubt. Each bait should be covered over with a small quantity of foliage or similar shelter, as this not only serves to keep the bran moist, but also tends to attract the beetles. When the bait has dried it may be moistened again with a watering can. Some farmers report better results with Paris green, but this chemical is sometimes difficult to procure and is more expensive than arsenite of soda. One pound of Paris green to 180 lbs. of maize meal is recommended. The use of sugar or molasses in preparing the bait is not always convenient or necessary, and adds considerably to the cost. A formula consisting of arsenite of soda 1 lb., cheapest sugar 8 lbs. (or molasses 1 gallon), water 20 gallons, has been successful. Chopped green stuff (such as Napier fodder or lucerne) is dipped in the liquid and distributed broadcast over the land in the early morning or evening. Alternatively small quantities of the bait may be placed under shelter, as in the case of the bran mixture.

It is to be realised that there is doubtless much room for improvement in connection with the formulæ and the method of application of these baits. Large numbers of the beetles have, however, been destroyed by the methods described. Further investigations will be carried out in the near future.

MYCOLOGICAL NOTES.

SEASONAL NOTES ON TOBACCO DISEASES.

3. Frog Eye.
4. White Mould.

By J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.,
Government Plant Pathologist.

Frog Eye.—One of the most serious diseases of the tobacco crop in Rhodesia, and one to which more attention needs to be paid by growers, is the leaf spot known generally as "frog eye." The idea still persists in some districts that frog eye is an unimportant disease which only appears on the bottom leaves of the plant, and that when these are primed off late in the season infection progresses no further. It would be as well if this illusion were immediately dispelled, because frog eye can cause heavy losses in individual crops, and two years ago was held responsible by a big buyer for putting a large proportion of that season's crop in the perished grades. The disease may be found upon almost any farm, and appears to be more prevalent now than it was some five or six years ago. If some whole-hearted attempt is not soon made to destroy old plants in the lands as soon as ever they have served their purpose, there is no knowing how severe frog eye may become within the next few years. It is to be hoped that the recommendations of this Department regarding early priming, which appear to be viewed more favourably since buyers have refused to take tissue-paper leaf, will be more faithfully adhered to in the future, so that we can anticipate a reasonable check being given to the disease before it establishes a firm hold upon the Colony.

Frog eye almost invariably makes it first appearance on the lower, yellowing leaves of plants in the seed beds. The spot is brown in colour, circular in shape, and often has an ashy-white spot in the centre, but this is not always present. If young plants are very chlorotic as a result of over-crowding or nitrate deficiency in the soil, then they may be severely attacked by the disease, so that most of the leaves possess large, circular, brown spots. In any case, as it is not usual to remove the lower leaves from seedlings before transplanting, the spot is transferred from the seed beds to the lands, and it is not unusual to find every plant over an area of thirty or forty acres bearing one to several leaves infected by frog eye. As has already been pointed out in this Journal and elsewhere, three or four leaves at the base of the plant should be primed off, carried from the field and *destroyed* as soon as possible after the plants begin to make growth, so that infection is removed before the new leaves appear. It is of no use to prime off spotted leaves and allow them to remain in the furrows, for the first heavy rain will wash the fungus spores from the frog eye spots on to the soil, from whence they will be splashed on to the lower leaves of the plants and initiate a further outbreak of the disease; the crop cannot then be freed from infection.

The chief danger does not, however, lie in the spotting which is seen in the field; it is the brown or black spots which develop in the barns at temperatures of about 115 degrees which are responsible for the greatest amount of damage to the crop. This spotting is the direct result of frog eye infection, and should be strictly guarded against by the methods already indicated; but if infection of apparently clean leaf has occurred and the barn spot has made its appearance, then it may be checked to a certain extent by giving ample top ventilation and reducing humidity to the lowest limit of safety.

Remember that early priming will protect your crop from black barn spot.

White Mould.—There is no need for a description of this disease, which is well known to all tobacco growers. Although it is styled white mould in Southern Africa, yet it would be more correctly named mildew, for it is a typical

powdery mildew such as is found upon marrow, cucumber, asters and many other plants.

It appears in the tobacco lands at any time after the beginning of February, and is first seen upon the frills of the bottom leaves when these are allowed to remain upon the plants. Its subsequent spread to leaves higher up the stalk may be slow or rapid according to the conditions under which the crop is growing. Where plants are large and growth is rank, the familiar powdery coating of mildew spores may appear suddenly upon three or four of the lowermost leaves, rendering them unfit for curing.

Certain anomalies appear to exist in regard to the conditions which render plants susceptible to infection, but the disease usually makes headway at the time of year when cold night temperatures are first experienced. Tobacco grown at high elevations usually becomes infected earlier than crops at lower levels.

Various methods of control have been and are still being tested by the Department of Agriculture and Lands, but the most economical yet found is aeration of the field by early priming off the bottom leaves of all plants. No reduction in yield occurs if high priming is carried out before the plants are large, and there is no doubt that the quality of the leaf is improved. Farmers who have tried early priming are quite satisfied with the results, so that it is to be hoped that this operation will be adopted on all farms as a normal routine practice.

One word of warning—**beware** of handling mosaic plants and healthy plants at the same time. Separate boys should be told off to prime the former, and all boys should be made to wash their hands at the completion of each row of priming. In this way the spread of mosaic throughout a field can be prevented.

A full account of the trials carried out in the past few years for the control of white mould will be published in this Journal at a later date.

THE PRESERVATION OF FARM BEACONS.

By L. M. McBean, Acting Surveyor General.

It is remarkable how apathetic is the average land owner in this country in regard to the existence, position and maintenance of the beacons demarcating his property.

In the case of the grant of Crown land, the Government undertakes to point out the beacons to the grantee, and obtains a beacon receipt, which indemnifies the Government from further responsibility in the matter. The conditions of the title deed also include a clause by which the owner is held responsible for the maintenance of his beacons. In the case of transfer of the property, these conditions automatically apply to the transferee, who should first satisfy himself on the other two points—viz., the existence and position of the beacons. This important matter is often forgotten, particularly when the sale of the land has been effected by an agent in an office, when in reality the deed and diagram are sold and bought and not the actual ground which they represent.

The object of this article, however, is to deal rather with the question of the maintenance of beacons.

Although there may be no immediate intention of selling the whole or a portion of a farm, it is a possibility to be borne in mind. Indeed, one has only to observe the land history of any older country to see that it is a probability. In the case of transferring the whole property, the new owner will need to be satisfied that the beacons are in order, and in the case of a sub-division, a survey will be required, and the surveyor's fees will be considerably heavier if the old beacons have first to be re-located and re-erected. Apart from the question of the survey fees, the fact of beacons

being allowed to fall into disrepair is liable to cause endless litigation, as has been so often experienced in the Union of South Africa.

Fig 1

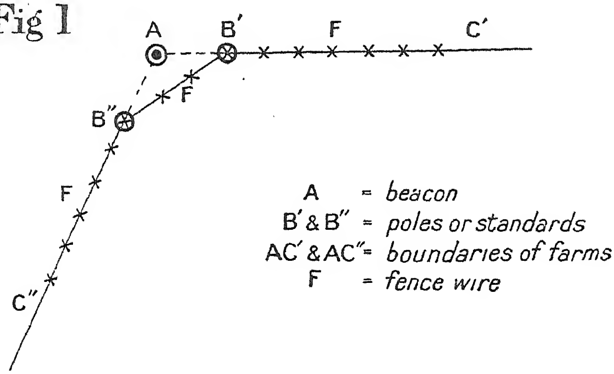
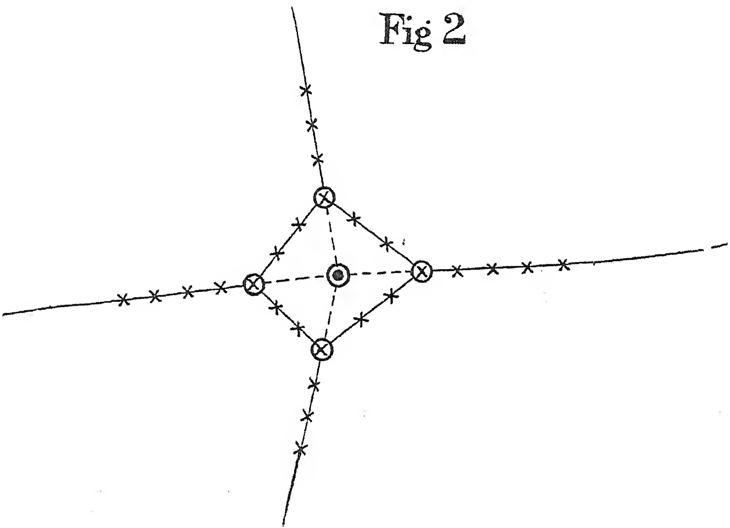


Fig 2



The chief trouble in this country, however, is not so much the passive neglect of beacons, but the wilful mutilation and often the outright destruction of beacons owing to the erection of fences. The prevailing custom is for the fencer to remove the beacon altogether, including the iron pin marking its centre, to dig a large hole and to plant

the corner pole of the fence therein. The pin and stones may or may not be replaced, but in any case the accuracy is gone, and the new mark is merely "somewhere about" where the original mark was placed. That beacon has now lost its value as an "original beacon," and is henceforth ignored both by surveyors and by the Court in cases entailing the "evidence of beacons." In other words, the fees paid for the survey of the land are a dead loss to the owner, since he has nothing to show for them but a diagram which may or may not represent the beacons of his ground.

The remedy is simple. Instead of having only one corner fence pole, terminate each line a few feet short of the beacon. (See Figure 1.) It might be argued that this means further expense to an already expensive undertaking, but I understand that it would only be a matter of 7s. or so at each point, and what is 7s. compared with £7 or more, which it would eventually cost to have the point refixed by survey? Also, granting the fact that fencing a farm is an expensive undertaking, the extra outlay of a few shillings would scarcely be noticed, and the advantages accruing would more than compensate for the extra expense.

Referring to Figure 1, the distance AB′ and AB″ should not be less than 4 feet, and the wires joining B′ and B″ should never be so close to the beacon as to interfere with its base.

Figure 2 shows the final result in the case of a beacon common to four farms. This beacon is left undisturbed and will remain so for generations—it is a real "landmark," and an indisputable beacon, and is automatically preserved by the enclosing wires.

If, therefore, farmers would bear this matter in mind and insist on this procedure when arranging for the fencing of their farms, they would save money, fulfil their obligations as to the maintenance of their beacons, and, at the same time, be doing a real service to Rhodesia in preserving such marks, which would be used as controls in the closer mapping of the country which must ultimately be undertaken.

ARE WHEEL-TYPE TRACTORS INJURIOUS TO TILTH?

The following short article has been taken from "The Implement and Machinery Review" of January this year. It raises a point which is of considerable interest and practical importance.

There is no doubt that the differences in the incidence of rainfall and general climatic conditions account for the very different soil conditions in this country from those in Great Britain.

We shall be glad, therefore, to hear from any users of tractors who are in a position to give any results on similar lines to those mentioned in the article or who would be prepared to make the necessary observations and supply this Department with the information gained.—Ed.

"Much might be said on both sides."—Addison.

"It is evident that wheel-type tractors have too long been blamed for their supposed ill-effects on the land and too little praised for the good they do, since an experiment which is even now being continued at the South-Eastern Agricultural College, Wye, Kent, shows, in the language of Addison's 'Sir Roger,' that there is no need to regard the matter from one aspect only. It would indeed appear that farmers have been too ready to talk about injurious 'packing' of the land and inventors have been too prone to devise 'non-packing' types of wheels, whereas the truth of the matter is that a good word can actually be said for the consolidation that the wheel-type tractor does. At any rate, it has been discovered, and it is put no higher than that for the moment, that during May of last year there appeared to be parallel lines of stronger growth in barley adjoining the experimental area at Wye, and it was established by the Engineering Department of the College that these lines were made by tractor wheels when disc harrowing two days before drilling the previous March.

The matter was thereupon closely investigated on the score of comparative plants per foot, tillers per foot, ears per foot, consolidation, and other factors with areas which had not been so over-run by tractor wheels, and it was seen that the differences in yield in favour of the tractor wheel track areas were most significant. Whether any other factors influenced the position materially or not cannot be excluded at the moment, but the point to be made is that here is sufficient proof to our minds that the talk about injurious 'packing' of the soil by tractor wheels has been a good deal overdone. Evidently the engineering authorities at Wye have also their reasonable doubts on the question of 'packing,' for they have decided to continue their experiments with a specially made roller, which has the same tread and pressure per sq. in. as tractor drive wheels. Three forms of treatment will be attempted, viz., unrolled, rolled in strips to see whether 'border' effects are responsible for the increase, and, finally, rolled all over to get a complete example of the compression. It would be injudicious to say more of the experiment at the moment, since those conducting it, although convinced of its possibilities, do not feel that anything really decisive has yet been obtained. But the further investigations which are now being made should at least provide useful data, and it is possible that some of the harsh things that have been said about wheel-type tractors and 'packing' may eventually be proved to be false and unsupportable.''

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

FARMING CALENDAR.

March.

BEE-KEEPING.

As the latter end of this month should herald the approach of the second and last real honey flow of the season, see that enough extra supers are ready for placing on hives as required, watching also that the fully drawn out combs of shallow frames that are on hand to fill them with are kept free from the wax moth; further, examine all supers that are already on the hives for this serious defect, though strong colonies will as a rule keep the combs free from this pest. March being usually a hot month, look well to the entrance; enlarge when and where necessary, and have ventilating lids on the tops of each hive. Extra ventilation can be provided for when required by placing small metal or wooden wedges underneath the top super, but not to be open enough to let out or in a single bee. Where quilts are noticed to have been eaten or more or less destroyed during the summer months, now is the time to make fresh ones so as to be ready for the closing down and the making snug of each hive when winter approaches; old flour bags or old deck chair canvas make capital quilts. Bees during this month will consume a quantity of water; see that some is always kept in the apiary in floating cork chips. This will save much labour and flight for them, as well as prolong their period of work and usefulness. As stated in last month's notes, flying swarms may be expected now any day, so prepare for their capture if required by having all details and items ready for immediate use. It is as well, however, at this date of the season to do without such swarms, unless the owner is prepared to feed them well during the winter months. March or April swarms, unless they are hived under conditions of providing all the frames, of fully drawn out old combs, do not as a rule have either the time or materials to provide for a strong colony before the winter sets in, and must perforce remain a weak one during that period. The axiom of every bee-keeper should be to let his colonies go into winter quarters brimming over with bees, not only to provide against the mortality that is bound to occur then, but to have a full hive to start the next season with.

CITRUS FRUITS.

Two thorough sprayings about this season, when the rains are usually practically over, at an interval of about two weeks, will often obviate the necessity for further work against scale insects until the beginning of the next wet season. If not already done, orchards should be ploughed and cross-ploughed and worked up into a really good surface, so that the cultivators can be kept going, say, every two weeks until it is necessary to irrigate, after which cultivation should be continued. If March prove a dry month, orange trees holding up a crop of fruit will probably require irrigation, but under normal weather conditions it should not be necessary. The same remarks apply as last month with regard to fruit moths. About the end of this month fall budding can be taken in hand, that is the insertion of buds that are intended to remain dormant until spring. This applies to higher altitudes, but in low country, where the growing season is extended, dormant budding should not be done until latter end of April.

CROPS.

Watch oats for rust, and, if badly infested, cut crop for hay as soon as weather permits. Ridge late potatoes, and if weather is dry prevent ridges from cracking, to check tuber moth infestation. Finish ploughing under all green manure crops while the ground is still moist enough to promote rapid decomposition. Late in the month begin to cut silage crops and ensile. Cut out barren maize plants and feed to stock or ensile. Cut Sudan grass for hay to permit of final late growth for autumn grazing. Reap any crops that are ready, and plough the stubbles **at once.** Lift ground nuts that are sufficiently matured. Watch for ground nuts making second growth; reap, and when sufficiently dry, place in cocks with nuts inwards and cover the top securely. Sow onion seed beds for winter crop. Watch the weather for hay-making and take advantage of fine spells. Towards the end of the month hay-making should normally be in full swing. Continue to plough all lands in succession immediately the crops are reaped from them. Vleis and irrigable lands should now be ready, or in process of being prepared, for winter crops. Early sowings of Algerian oats, barley or rye for green forage can be made. Allow any potatoes lifted to dry before storing them, but do not leave too long in the sun. Destroy witch weed and other noxious weeds. Continue to make all the kraal manure possible by throwing grass and litter into kraals, yards, etc. Begin to select in the field maize plants for seed purposes, and mark them with slips of coloured cloth. Press on with the breaking up of any virgin land which may have been stumped or cleared earlier in the year. Place orders for grain bags without delay. Early in the month silage pits should be cleaned out or, where necessary, new pits dug.

DAIRYING.

This is usually the most favourable month of the year for dairy operations. Cooler nights are now in evidence, and there is usually little difficulty in maintaining a low temperature in the dairy and cheese-room. If elementary precautions are taken, all cream should be first grade, and first-class cheese should be made, as a gassy condition of the milk is rare. Dairy cows, unless they are very high producers, can go without extra rations, because the grass is now in seed and grazing is ample. The cheese storeroom is generally full of cheese, and care should be taken to turn the cheese regularly. The windows and doors should be opened at night and closed in the daytime. A little mould on the cheese will not affect its quality, but if the mould is excessive the cheese should be rubbed daily.

Calves which are under four months old should be kept in and allowed to nibble at well-got hay; at the same time a little dry mealie meal and monkey nut cake will do them good and teach them to eat concentrates. An ample supply of clean water should be provided in the calf run.

ENTOMOLOGICAL.

Maize.—The stalk borers of the second brood may now be found in the stalks, but nothing can be done at this stage. Caterpillars sometimes attack the crop as a sequel to cultivation after grass weeds have made too much growth. The caterpillars attack the crop on account of their more natural food being suddenly destroyed. Prevention and not cure is indicated.

Tobacco.—The crop will by this time mostly have outgrown insect injury, but leaf miners and budworms may be in evidence. The latter are usually destroyed by hand when topping. Any plants affected with stem borer should be removed and destroyed.

Potato.—If ladybird beetles or caterpillars are injurious, spray with arsenate of lead (powder) 1 lb. to 30 gallons of water. Careful hilling should be attended to with the object of preventing and checking tuber moth attack.

Vegetable Garden.—If sawfly attacks plants of the cabbage family dust with Paris green 1 lb., fine sifted slaked lime 20 lbs. Against cabbage louse (aphis) wash plants frequently with a strong spray of water. Destroy blister beetles by hand. Plants of the melon family may be baited regularly with arsenate of lead (powder) $1\frac{1}{2}$ ozs., treacle $\frac{1}{2}$ gallon (or cheapest sugar $2\frac{1}{2}$ lbs.), water 4 gallons, to keep down fruit flies. For leaf-eating caterpillars and beetles, etc., spray with arsenate of lead (powder) 1 lb. in 30 gallons of water on foliage which will retain water. Cabbages are best dusted.

Citrus Trees.—Collect and destroy infested fruit to keep down citrus codling. Fruit-piercing moths sometimes attack the fruit during the month, especially navels. They work at night and can only be dealt with at present by hand destruction. The trees should be watched for development of aphis and soft brown scale on the young growth and prompt measures taken. Resin wash at two-thirds standard strength is suitable.

Mosquitoes, House Flies, etc., may be very prevalent during March. Destroy breeding places. Poison or trap adult flies. Attend to screening of residence.

FLOWER GARDEN.

Flower seedlings for winter blooming should now be coming on, and should be planted out during showery or cloudy weather. Cuttings of carnations may now be made, and should be taken from selected plants which have borne the choicest blooms. The cuttings should be dibbled in half paraffin tins containing three parts sand to one of loam, and kept in a moist condition in a shady position sheltered from the winds. Make main sowing of winter-flowering sweet peas in a well-prepared and rich soil.

VEGETABLE GARDEN.

The sowing calendar is the same as that recommended for last month. Plant out from seed beds cabbage and cauliflower; care should be taken during this month, as the end of the rainy season approaches, to dig with a fork all the ground in the garden. The heavy rains settle this down hard, and as soon as the dry weather begins the soil cracks and lets out all the sub-soil moisture by evaporation. As soon as the rains cease entirely it is advisable to go over the ground and fine down with a rake, leaving some three or four inches of quite fine soil to act as an earth mulch.

FORESTRY.

Cultivation where necessary should be undertaken between the rows of trees planted out in previous months. If cultivation is carried out with the hoe, care should be taken not to pile earth round the base of the stems. New ground for next season's planting should be roughly broken up with the plough. Bulk plantings may be proceeded with during the month.

GENERAL.

At this time the condition of stock on the veld is usually good. It is well, however, to look ahead and make ready for the coming winter by the provision of winter feed in such forms as veld hay, silage, baled fodder from maize, manna, oats, teff, velvet beans, and the like, and by taking steps to ensure that water will be available for the stock in winter as near their grazing ground as may be.

POULTRY.

The breeding pens should have all been mated up by now, as the first chicks should be out by the beginning of April. Much more care should be used than is usually the case when selecting birds for breeding. Only the very best, i.e., the strong, healthy, vigorous ones from the best layers, should be chosen. A pamphlet on "Selection and Mating for Improvement" can be obtained on application to the Editor or the Poultry Experts. This deals fully with the subject. Always keep an eye on the male bird;

many are apt to get thin and run down in health, due to their allowing their mates to eat all the food. Such birds are better breeders than those that chase their mates away from the food. Every male that is being bred from should be given a good meal by himself each day, to ensure health and vigour. The incubator should be thoroughly overhauled, cleaned and disinfected before the eggs are put in.

STOCK.

Cattle.—Arrangements for winter feed should be pushed on. For a well balanced winter ration, in addition to good quality veld hay, a succulent feed such as maize silage, majordas or pumpkins and a legume hay such as velvet beans, cowpeas or dolichos beans are essential. The milk supply will begin to decrease. In the case of cows rearing calves it is often good policy in this month to cease milking the cows and to allow the calves to get all the milk from now on. Slightly increase the amount of grain to the dairy cows and increase the proportion of protein concentrate in the dairy cow mixture to make good the usual loss of feeding value in the grass. Bullocks fattening on grass will do better for a daily ration of some succulent feed such as green mealies or sweet potato tops.

Sheep.—Grass seed may be very troublesome. Keep the sheep on short grazing, or, alternatively, put them on to grazing which has been mown. Crutch the ewes due to lamb.

TOBACCO.

All late plants should be topped low to hasten maturity. The bales of cured leaf should be examined to ascertain whether or not the tobacco has been baled in proper condition. Seed heads should receive continued care. Land ploughed during February should be disced and rolled to assist the decomposition of organic matter. Tobacco fields already cleared of plants should be immediately ploughed. Tobacco bulks should be examined and turned, if necessary.

WEATHER.

Rains may be looked for in considerable quantity, though less than in previous months, 5 inches in Mashonaland and 3 inches in Matabeleland being normal, with as usual more on the eastern frontier. No useful rain need be reckoned upon after the end of this month, except on the eastern border, but the rainy season tapers off in an irregular and often erratic manner and without certainty.

April.

BEE-KEEPING

The notes given for last month will in the main apply to April also, according as to how the season develops. New swarms are not recommended to be hived during this month unless they are supplied in the first instance with fully drawn out frames and the owner is prepared to feed them now and again during the winter. As April should be a very active month for the bees, watch carefully the progress of the crates in which surplus honey is being stored, and have plenty of frames—fully drawn out if possible—ready fixed with foundation so as to place on extra crates as occasion may require; these should be placed under the full or filling one and not on the top, as might appear the case. For the benefit of those who would like a little honeycomb, it might be stated that if two or three shallow frames are fitted with four empty comb sections, and

placed in the crate, the bees will take to this plan and so provide both comb and honey for extraction in the one crate. In this African climate full crates can be left on the hive with safety until ready for extraction, but if any are taken off they must be watched now and again until they are extracted for damages from the wax moth, which in a day or so can ruin both the comb and honey.

CITRUS FRUITS.

During the first half of this month, autumn budding can still be performed if the sap is still up and the bark of the stock slips freely. Unprofitable and off type trees that have been headed back for top working and which have been carefully thinned out may have the shoots on which February-March buds have failed re-budded to profitable varieties. If the March rains have been sufficient and ploughing and cultivation have been completed, continue cultivation to retain soil moisture and destroy winter weeds. If a dry March has been experienced and cultivation has been badly performed, irrigation should be commenced or continued to keep the trees and fruit in good order. If not already applied to the unthrifty trees which are late with their autumn flush, soluble fertilisers containing nitrogen and phosphoric oxide can be applied with advantage to these trees. The fertiliser should be worked into the soil with a cultivator and followed up with an irrigation. Exporters should have everything in readiness for packing the early fruit, which should be fit to market about the end of the month. Scale infested fruit will be unfit for export unless treated at once. See entomological notes for treatment.

CROPS.

If sufficiently mature, begin cutting and stooking early maize over a small acreage and plough up the ground whilst still damp between the rows of stooks. If ripe, reap and husk early planted maize, and keep in a separate dump. Continue to make field selections of the best maize plants, and mark those required for seed with strips of coloured cloth. Lift any ground nuts and potatoes showing signs of making second growth. Make silage; cut maize for this when the ears are in the "dough" stage. Pick up and stook maize plants blown over to protect the ears from white ants. Feed sweet potato vines to stock, reserving any new growth of vines for feeding as grazing in May. Plough in any green manure crops not already turned under. Plough fallowed land. Keep potatoes reserved for seed on racks in a cool place protected from frost, but well ventilated. Transplant onions from seed-beds to irrigated or naturally moist lands; irrigate about once a week, but do not apply too much water. Pick over potatoes which may be lifted, and remove the bad and diseased ones. Winter cereal crops for grain can be sown towards the end of the month. Cart manure to the lands. Remember that good and deep ploughing to a depth of at least 7 to 8 inches is essential, and the basis of all successful arable farming. If the lands are not already ploughed so deep, increase the depth of ploughing about an inch a year until this depth, or even more, is reached. On lands which have been ploughed for a number of years at the same depth, use a grubber to stir up the sub-soil without lifting it to the surface. Too much attention cannot be paid to good tillage. It is usually good practice to follow the plough at once with a harrow or other suitable implement to break down the clods before they bake hard. Continue breaking up new lands; the earlier this is done the more complete is the decomposition of the vegetable matter in the soil. When making hay of coarse legumes such as velvet and dolichos beans and cowpeas, be sure that the vines are dry before stacking. Handle the hay as little as possible to avoid loss of leaf. Thought should be given to laying in supplies of thatching grass for thatching and repairing roofs. The veld may be beginning to dry off. Consideration may be given to mowing or otherwise preparing fire lines as a preventive against veld fires.

DAIRYING.

At this season of the year the milking kraal is generally far from clean owing to the excessive amount of mud or dust which has accumulated during the latter part of the rainy season, and in consequence farmers invariably have trouble in producng first-grade cream. Every endeavour should be made to erect a small milking shed in which four or five cows or more can be milked at a time, and every effort should be made to keep the cows clean. The udders should be wiped before milking with a clean, damp cloth, and the farmer should see that the natives' hands are washed with soap and clean water before and after each milking.

If butter is made, the cream and washing water should be put out overnight, and if the cream is churned early the following morning, very little difficulty should be experienced in obtaining a good grain and a firm body in the butter.

From this time of the year onwards, cheese making operations are usually most successful. The evening's milk should not be kept in the dairy, but should be placed outside, preferably in a bath, and covered over with butter muslin, cheese cloth or mosquito gauze netting. Care should always be exercised, however, in using evening's milk. Morning's milk plus a starter usually gives the best quality, and if a starter is used, care should be taken that it shows no signs of gasiness or off flavours.

The season of abundant green pasture is over, and the natural grazing, unless supplemented by some green food or succulent roughage, is not sufficient to maintain a full flow of milk. The most economical supplement to veld grazing at this time is maize silage, and this should be fed in liberal quantities to all milking cows and growing stock. A few pounds of concentrates in addition would also be of great benefit to the milking cows, which should not be compelled to subsist entirely on veld hay and silage.

DECIDUOUS FRUITS.

If not already done, orchards should be ploughed, harrowed and well cultivated to retain the soil moisture for spring blossoming and growth. Varieties such as the Chinese peaches, etc., may be pruned after the leaves have dropped.

Order all trees for winter planting during June-July. August planting is unsafe for many early growing varieties of fruits.

All late apples should be harvested and stored or marketed.

ENTOMOLOGICAL.

Maize.—Although certain pests, such as earworm and stalk borer, may be in evidence, there are practically no operations against insect pests that can be carried out economically during this month.

Tobacco.—Any remaining plants showing stem borer attack should be removed and burnt. Watch should be kept for the emergence of the adult wireworm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20-30 gallons of water. The bait should be rolled into a small ball and scattered on the lands, one ball to each 10 square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 8 lbs. per 10 gallons. The bait is best laid in the evening.

Cotton.—Damage to bolls from bollworms may be noticed by the flaring of the bracts and the dropping of the bolls. All dropped bolls should be collected and destroyed. Guinea-fowl, turkeys, etc., may be encouraged to destroy stainers, etc. Stainers should be trapped in traps of cotton seed or trash and destroyed.

Citrus.—Collect and destroy infested fruit to keep down citrus codling moth. Red scale should be destroyed by fumigation with hydrocyanic acid gas or with resin wash. Soft brown scale may be controlled with resin wash. It will be controlled by fumigation with hydrocyanic acid gas where this is practised against other scale insects. Aphis may develop on young growth and may be kept down by spraying with nicotine or home-made tobacco wash.

Vegetable Garden.—Plants of the cabbage variety are liable to suffer severely from cabbage louse and Bagrada bug. The former can be kept largely suppressed by frequent washings with a strong spray of cold water or with a nicotine spray. Bagrada bug is more difficult to control. Crude carbolic emulsion, 1 part in 15 parts of water, or resin wash gives partial control. The spray must hit the insect to kill. Do not re-plant a cruciferous crop (cabbage family) on the same plot. Thoroughly clean and work the soil.

Potatoes.—Potatoes should be cultivated systematically and hilled up to keep the tuber moth from the tubers.

FLOWER GARDEN.

The garden can generally be depended upon to make a good show in the autumn and early winter, provided that the plants have been previously kept in a healthy condition by watering, mulching and feeding. Snap dragons and other seedlings, also cuttings, may now be planted out into their permanent positions. Sowing may be made of hardy annuals, such as hollyhocks, larkspur, clarkia, pansy, petunia, sweet peas, gaillardia and candytuft. Bulbs of spring flowering plants may be taken up, divided and replanted.

VEGETABLE GARDEN.

Sow at once all that is required to fill up the vegetable garden before the soil has parted with all moisture. Seeds sown now will germinate freely, and plants will establish themselves more quickly than during the colder weather, which can soon be expected. A start should now be made at cleaning asparagus beds. This is a most popular vegetable, and yet one rarely sees it cultivated in the ordinary Rhodesian garden. It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily managed vegetables in the whole garden. Depth of good soil and plenty of manure are all that this plant requires. Rhubarb roots may be taken up, divided and replanted this month. Plant out from seed beds cabbage and onion plants into their permanent quarters. Sow a full crop of peas, broad beans, turnips, onions, lettuce and radish.

FORESTRY.

Cultivate the soil in the young plantations either by means of machines or hand labour. The cultivation will conserve moisture. Hoed out weed growth should be applied as a mulch round the base of each young tree. Be careful not to pile earth round the stems of the young trees. Covering the stems with earth even for an inch or two interferes with sap circulation and invites attacks by termites.

Prune the young trees to single stems. Any exceptionally strong undesirable branch growth may be checked by breaking off the leading shoot, but ordinary branch growth should not be touched.

POULTRY.

The first chicks should now be out, and these, having been hatched, must be well looked after. No food should be given for the first 36 to 48 hours. Leave them to sleep as much as possible. See that they have plenty of fresh warm air, but are not exposed to draughts. After 48 hours give some small grit and charcoal to purify the intestinal tract and aid digestion. A pamphlet dealing very fully with incubation and rearing of chickens can be obtained gratis on application to the Poultry Experts, Department of Agriculture.

One comes across many cases of wrong treatment of chickens in this country, the chief being uncleanliness, over-crowding, giving food too early and dirty drinking water. Two most important foods are animal protein, especially in the form of thick separated or whole milk and green food, especially onions or eschalots or their green tops. The loss in the rearing of chicks is very great; this should not be so if good breeding stock is used, the eggs from these are carefully handled and incubated and the chicks reared with care and common sense.

Any turkey chicks hatched at this time of the year should be well looked after. They should be kept warm, dry, free from insects, fed on dry food only, given plenty of thick separated milk, onions or onion tops, dry mash and grain. A pamphlet on turkeys and turkey rearing is obtainable gratis from the Poultry Experts.

Ducks should do well during the month, the weather being as a rule cool, moist and bracing; but the houses in which they sleep must not be damp. Duck breeders should always be on the "qui vive" for a round worm called "Trichosoma contortum," which is often fatal to ducks. It is found in the œsophagus, and causes arrest of growth, emaciation and weakness and sometimes epileptiform attacks. A swelling will be noticed at the lower part of the neck, which rapidly increases in size, and death occurs in one to three days. Onions, or preferably garlic, mixed with the food is a good preventive and cure. Another good remedy is essence of turpentine mixed with twice its quantity of olive oil and one or two tablespoonfuls given for a dose.

STOCK.

Cattle.—Where winter conditions are good, early spring calves may be weaned now, but a common practice is to allow them to run with their dams until the early rains. Where supplementary feed is available, April to June are probably the best months of the year for cows to calve in. These months also suit the dairy farmer. Provide succulent feed for the dairy herd. Dry off cows which will not pay for a grain ration during the winter. Bullocks for winter fattening should be selected now.

Sheep.—The ewes should be kept in good shape for lambing. Put the big udder ewes on the green feed.

TOBACCO.

The grading of the brighter grades should be proceeded with as soon as convenient. All leaf which has cured green should be bulked separately and be regularly examined to avoid serious damage through overheating. Tobacco seed heads, when mature, should be removed from the plants and stored where no damage will occur through activities by rats and mice. Care should be taken to store these seed heads with the pods uppermost, as otherwise much seed may be lost. Clear and plough the land soon after the crop has been harvested. Burn old stalks as a control measure against possible carry over of disease

SOUTHERN RHODESIA VETERINARY REPORT.

December, 1931.

AFRICAN COAST FEVER.

No fresh outbreaks. The slaughter of the infected herd on the farm Hillside, Melsetter district, had not been completed by the end of the month.

FOOT AND MOUTH DISEASE.

Victoria Veterinary District.—The District Veterinary Surgeon reports as follows:—

"No fresh infection occurred during the month, but there were several recrudescences of disease in areas where it was considered infection had disappeared, but where all cattle had not been definitely known to have picked up the original infection.

"It is also of particular interest that all recrudescences were the result of recommencing dipping, thus tending to show that the fact of bringing cattle in close contact at the tank kraal is sufficient to ensure a rapid spread of infection, as in each case the spread of infection was noticed within a month of the first dipping, usually on the third dipping day—that is, a fortnight after the initial dipping.

"It further appears very definite that once infection gets into any large native area it remains in that area until all cattle have been exposed to infection, and is capable of causing a recrudescence in clean cattle for long periods after all active infection appears to have died out. Take Mataruse tank area, Victoria Reserve, as an example: All evidence of any active infection disappeared early in September, when 26 herds still remained clean. Dipping commenced early in December. At the third dipping, i.e., 14 days afterwards, 16

of these herds showed infection with a high percentage of infection. A similar condition was noticed in the Chibi district at M'Seba, Gororo, Shiko and Matenda tank areas; except at the former two tank areas, infection was thought to have disappeared towards the beginning of June, and except for the fact of finding a koodoo bull with lesions of foot and mouth and the assumption at that time that game would probably be a factor in spreading infection, these areas would have been shown as cleared up months ago.

"In view of this experience, it seems that once any native area becomes infected, every effort should be towards exposing all cattle to infection as quickly as possible, and that our past method of dealing with these areas by segregation and suspension of dipping is wrong, unless there is some special reason why the spread should be retarded, and further, it would seem that a rapid spread with a high percentage of infection can be obtained by bringing all cattle in close contact at the dipping tank, in which case the question of inoculation to accomplish a similar condition may not be necessary, and need only be resorted to if the former and more simple method fails.

"In existing areas of infection other than those mentioned, the disease is running the usual course, except on Maybrook Farm, where infection is in a very mild form and is only slowly spreading in any visible way.

"There is still slight infection remaining at Maranda's, but disease has entirely disappeared in Matibi No. 1 Reserve.

"There has been no further spread in the Chikwanda Reserve, but I am of opinion the disease will eventually spread to the balance of the cattle.

"Zimutu Reserve was cleared up during the month."

Gwelo Veterinary District.—In the Chilimanzi Native Reserve infection appeared amongst some herds in the Gundura section, which had not been infected previously. Infection is still active in the Janjuri and Rutunga sections of this reserve. The disease is clearing up on the farm Driefontein, but is still active on the adjoining farm Grootfontein.

In the Selukwe district fresh outbreaks occurred on the farms Lubonga, Pakame, Gundule, Guruguru and Wilsons.

In the Selukwe Native Reserve infection appears to be at an end.

Fresh infection appeared in the northern section of the Lundi Reserve, Belingwe district, which escaped the disease during the earlier stages.

In the Gwelo district some slight infection remains on Vigers.

BULAWAYO VETERINARY DISTRICT.—In the Bubi district the whole of Battlefield Block is now infected except one kraal, and infection extended to three herds on the adjoining Ntabezinduna Native Reserve, in the immediate vicinity of the Battlefield Block boundary. Infection reappeared on the Shangani Ranch. The homestead paddock was first infected, and infection was carried from there to other paddocks by ordinary ranch movements.

In the Belingwe district the disease advanced on the Belingwe Native Reserve from the vicinity of the Mondi River, north of the Mwesa Range, in a south-westerly direction as far as the Nuanetsi River, and across the Biti River, in the vicinity of Rupongi Hill. Infection is still active on the farms Mnene, Mnene Extension and the Bala section of Lou Estate.

In the Gwanda district all cattle along the Limpopo River between the Pazhi and Tshilatshokwe Rivers were moved back to Masera tank. On Liebig's Ranch some infection still exists on Sections 1, 4, 6 and 9. The only cattle on this ranch which have not been infected are one herd at Mazunga and eleven herds in the north-west corner of Section 7. In the Siyoka area infection spread up the Msano River to the north of Mahado Halt, and all the cattle involved were removed to Siyoka for inoculation. The disease crossed the cordon line on the Tshabezi River, and all the cattle involved were moved to Siyoka for inoculation.

Inoculation: 5,959 head of cattle were inoculated at Simales kraal and 100 per cent. reactions resulted in susceptible cattle. It was noted that animals which had previously had an attack did not react to inoculation. Infection on the Bubye and Bubyana Rivers appears to have died out.

SALISBURY VETERINARY DISTRICT.—Fresh infection was found at several kraals in the Chiweshe Reserve, Mazoe district. This reserve was infected in July last, and the disease appeared to have been confined to three kraals and to have disappeared, as there had been no evidence of infection since October last. It was decided to inoculate all the cattle in the dipping tank areas involved by the fresh infection, and at the end of the month this work was in progress. No evidence of infection at or in the vicinity of other previously infected areas.

SCREW WORM IN CATTLE.

Prevalent in various districts. In the Victoria district it is proving a severe and troublesome complication in cases of foot and mouth disease with open foot lesions.

TRYPANOSOMIASIS.

Several deaths in cattle reported from the southern portion of the Melsetter district.

SCAB IN SHEEP.

The District Veterinary Surgeon, Melsetter, reports that on inspecting a flock of sheep after double dipping at an interval of ten days he was able to demonstrate the living parasites in the infra-orbital fossæ of Merino sheep, and points out that failure to deal properly with this site must lead to recurrences of infection.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate:—Bulls, 2; cows and heifers, 156; oxen, 67; horses, 7; donkeys, 48; sheep, 1,727; goats, 128; pigs, 20.

EXPORTATIONS.

Nil.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA WEATHER BUREAU.

JANUARY, 1932.

Pressure.—Pressure was generally above normal during the month and the fluctuations were small.

Lows.—Numerous lows were in evidence, but their effect was small. A deep low was on the south-east coast on the 1st, and appeared to move up the Mocambique Channel. This is very unusual. Two weak lows passed along the south and south-east coasts early in the month, and the second was succeeded by the equatorial low which extended well into the Union on the 12th; it moved to the west on the 13th, deepened on the 14th, and swung to the south-east on the 15th; movements continued to the 18th. On the 21st and 22nd a weak low passed along the south coast, and was succeeded by the equatorial low which extended into the Union and Southern Rhodesia and finally withdrew on the 28th.

Highs.—The movements of highs were generally weak and irregular.

A high appeared on the west coast on the 1st and passed off. The second appeared on the 4th and moved round, controlling the pressure system until the 11th. The third appeared on the south-east coast on the 19th and was in evidence up to the 22nd.

Temperature.—Temperature and humidity were generally about normal.

Rain Periods.—Rain fell in two periods during the month. Light showers were numerous on the 1st and fairly general in the north on the 2nd and 3rd; numerous in the north on the 4th, and isolated showers fell from the 5th

to the 7th. Isolated showers fell on the 12th and 13th, and showers were fairly general from the 14th to the 19th; from the 20th to the 22nd showers were more general in the south, but became general from the 23rd to the 25th. The rain fell off from that date and was confined to the north to the end of the month.

Rainfall.—The rainfall for the month was 5.5 inches, as compared with the average of 7.1 inches. The distribution was as follows:—

Zone.	Rainfall, Jan., 1932.	Average, January.
Zone "A"	6.7	6.3
Zone "B"	4.0	5.6
Zone "C"	6.3	7.6
Zone "D"	5.0	8.2
Zone "E"	5.2	7.8
Zone "F"	5.1	12.5

The heavy rain in Zone "A" and the very low rainfall in "F" are outstanding.

JANUARY, 1932.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen ° F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet).
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. ½ Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal.	No. of Days.	
Bulawayo ...	867.7	866.5	95	52	83.0	61.5	72.3	71.4	71.3	63.0	63	58	6.0	4.32	5.8	6	4,436
Gwelo	861.5	...	93	53	82.1	60.6	71.4	71.4	70.8	64.2	70	61	4.5	4.99	6.0	16	4,632
Riverbank ...	...	...	102	55	86.4	62.2	74.5	74.4	73.4	65.6	66	61	...	6.39	6.3	15	4,100
Essexvale ...	...	...	102	50	87.9	64.3	76.1	73.9	71.9	64.8	68	61	..	4.79	6.4	12	3,828
Gwanda ...	909.1	...	102	56	86.8	65.4	76.1	...	75.5	65.8	60	61	4.2	3.64	5.8	5	3,235
Mazunga ...	947.6	945.6	104	56	91.9	66.8	79.4	78.8	78.0	62.0	39	51	5.5	4.48	3.3	8	1,970
Nuanetsi ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3.7	...	1,630
Between Rivers	...	...	92	52	84.9	60.4	72.7	...	71.2	66.0	76	63	6.6	5.83	7.6	14	3,970
Enkeldoorn ...	...	...	89	53	80.3	59.9	70.1	70.2	70.3	63.3	68	60	5.2	7.73	7.1	15	4,720
Gatooma ...	...	...	95	52	85.6	61.2	73.4	74.3	73.2	66.4	70	63	5.6	7.40	7.6	17	3,850
Miami	...	...	87	57	80.2	62.7	71.5	...	69.2	64.9	80	63	5.8	5.23	9.1	16	4,090
Salisbury ...	854.1	853.6	86	51	79.7	60.0	69.9	69.3	69.3	63.1	71	60	6.9	5.15	6.1	15	4,865
Sinoia, Citrus ...	...	...	...	55	...	61.5	...	...	72.8	66.9	74	64	...	4.50	7.6	10	3,830
Sipolilo... ...	...	...	88	54	81.2	62.9	72.1	...	71.9	65.5	71	62	5.9	3.37	9.0	11	3,900
Juliasdale ...	...	...	81	47	72.3	54.7	63.5	63.3	65.3	61.2	79	59	...	8.70	10.9	16	6,070
Mtoko	...	...	86	55	79.8	61.8	70.8	...	71.1	65.0	72	62	6.1	4.85	8.1	6	4,210
Shamva ...	...	...	92	55	85.5	64.0	74.8	...	74.0	68.0	72	60	5.8	3.19	8.1	9	3,170
Angus Ranch ...	...	...	100	60	89.8	70.0	79.4	77.2	78.5	70.7	68	67	...	4.23	5.8	9	2,300
Craigendoran ...	...	...	96	54	85.9	62.9	74.4	...	78.4	68.2	59	64	...	3.50	8.1	12	3,430
New Year's Gift	...	...	92	56	84.2	63.3	73.8	...	73.7	67.0	71	63	...	4.52	8.3	10	2,700
Nyamasanga ...	...	...	84	...	78.4	...	...	...	69.3	62.2	67	58	...	6.85	...	15	5,680
Riverdene North	...	...	96	50	85.5	61.2	73.4	...	72.2	66.0	72	63	...	4.20	7.6	12	3,700
Stapleford ...	...	...	80	44	71.7	54.6	63.2	...	65.4	61.0	78	58	6.1	11.26	18.8	18	5,450
Umtali	891.6	890.7	93	52	81.5	62.0	71.8	71.9	72.5	65.5	69	62	4.7	3.73	8.4	13	3,677
Victoria ...	894.2	893.0	94	53	82.2	60.5	71.4	72.3	72.5	66.6	73	63	6.2	7.55	6.5	15	3,570
Melsetter ...	849.4	...	84	51	75.6	58.3	66.9	...	68.7	62.9	72	59	3.5	5.06	11.8	14	5,060
Mount Selinda	...	...	89	50	78.5	60.2	69.4	...	71.1	64.7	71	62	5.6	6.53	16.0	13	3,520

GWEBI PRODUCE PRICES.

Hull-less oats	40/- per bag of 150 lbs.
Large Black sunflower seed ...	14/- per bag of 100 lbs.
Dolichos beans	35/- per bag of 200 lbs.
Linseed	60/- per bag of 200 lbs.
Linseed (quantities under 100 lbs.)	4½d. per lb.
Sweet potato tubers (Calabash Leaf)	6/- per bag of 150 lbs.
Napier fodder roots	6/- per bag of 40 lbs.
Sweet potato cuttings (Calabash Leaf)	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.
Pumpkin seed	1/1 per lb.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

DEPARTMENTAL BULLETINS.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.

No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.

No. 429. Propagation of Kudzu Vine, by H. C. Arnold.

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No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.

No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.

No. 550. Onion Growing under Irrigation, by C. Mainwaring.

No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.

No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.

No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.

No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.

No. 630. The Storage of Seed Potatoes, by H. C. Arnold.

No. 634. Barley, by P. V. Samuels.

No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.

No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.

No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.

No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.

No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.

No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.

No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.

No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).
No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.
No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.
No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.
No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.
No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.
No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.
No. 759. Witch Weed (Striga Lutea): Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.
No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.
No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.
No. 781. Agricultural Costings at the Gwebi Farm—Maize and Green Manuring, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.
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No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.
No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.
No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.
No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.
No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.
No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.
No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.

No. 833. Subterreanean Clover on the Sand Veld as Feed for Poultry in the Winter, by S. D. Timson, M.C., Dip.Agric.(Wye).

No. 836. The Potato, by S. D. Timson, M.C., Dip.Agric.(Wye).

No. 837. Veld Grass Silage—A Feature in Rhodesian Pasture Management, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief, Division of Plant Industry.

No. 838. Witch Weed—Progress Report and a Warning, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

No. 841. Poisonous or Suspected Poisonous Plants of Southern Rhodesia: Tulp Poisoning of Cattle, by Sydney M. Stent, Senior Botanist, and D. A. Lawrence, B.V.Sc., Veterinary Research Officer.

REPORTS ON CROP EXPERIMENTS.

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How to Make Use of the Fencing Law.
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Summary of the Game Laws of Southern Rhodesia

THE RHODESIA

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EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Charges for Analysis.—Attention is called to the scale of charges for analysis by the Chemical Branch of this Department, which is reprinted in this issue from the *Government Gazette*.

It will be noted that all samples for analysis are to be delivered free of cost to the Department and must be accompanied by a remittance to cover the cost of analysis, and that no modification of the fees stated will be made except with the authority of the Minister.

No charge will be made for a partial analysis of soil samples from *bona fide* farmers when undertaken to determine the suitability for crops and/or to make suitable recommendations regarding fertiliser requirements.

In every other case a charge will be made.

The Department often has requests for complete or partial analysis of a well known fertiliser. These are appar-

ently made with the idea of checking up the composition with the advertised standard. There is absolutely no need for farmers to make such a request, since the analysis is constantly checked under the requirements of the Fertilisers and Farm Foods Ordinance.

Contour Ridges.—The particularly fine rains which have been experienced in most districts during this present season have awakened renewed interest in contour ridges.

A considerable number of enquiries have been received, and it has been considered desirable by the Irrigation Branch of this Department to review the position.

In this issue Mr. R. H. Roberts, the Assistant Irrigation Engineer, replies to some of the questions raised, and his explanations should allay some of the fears that have been expressed by farmers in respect of contour ridges which they had previously constructed on their farms.

The question of soil erosion is such an important one that we have no doubt that the review appearing in this issue will be welcomed.

The World Wheat Position.—A comprehensive and interesting review of the world wheat position was published in February last as the 20th Report of the Imperial Economic Committee.

It deals with a large variety of the more important aspects of the subject, reviewing the trend in prices, production, acreage, yield, etc. The technical advances, the variations in consumption and the various actions which have been considered necessary by the various States is also reviewed, and a number of graphs and statements at the end enable a large amount of material to be condensed into a report of about 120 pages.

The present outlook may be summarised by the following extracts:—

"The outstanding feature of the wheat situation is the catastrophic fall in price since the autumn of 1929 following upon a relatively slow downward trend in prices since 1925.

We have set out the main factors which have contributed to this result. Our general conclusion is that the fall in prices cannot be explained solely by reference to the supply position, but is a result partly of the development of supplies, partly of the spread of the economic depression. The term 'over-production,' which in recent years has been so frequently applied to the wheat situation, is obviously a relative one. Our own view is that if applied to the post-war period as a whole it is misleading. Over-production has not been the outstanding feature of these years if we have regard to pre-war trend—rather the reverse; nor in our judgment does over-production describe the salient features of the last two years. The truth of the matter lies much deeper. The many economic impediments—largely the outcome of the war—which have obstructed the full development of the world's economic life during the last thirteen years and the setback in economic progress brought about by the depression of 1930 and 1931 are factors at least as important as the expansion of production in accounting for the low level of wheat prices. Nevertheless the position which has been reached is equivalent to one of over-production in relation to effective demand, and has led to a situation in which wheat production has ceased to be profitable over vast areas of wheat-growing land. . . ."

"On such figures as these it is impossible to forecast even approximately the course of wheat prices over the coming twelve months. So much depends upon the developments of the world's general economic situation that a forecast related merely to the statistical position of wheat cannot to-day be of much value. It would be a mistake to look for a rise in wheat prices solely to the restriction of production. Hope lies, at least as much, in a recovery from the world-wide economic depression, which affects manufacture and commerce as well as agriculture. The problem of wheat is fundamentally a part of the general problem. The removal of the obstacles which to-day impede the recovery of industrial life would go a long way towards bringing about an improvement in the wheat situation."

Arsenic on Citrus Trees.—During the last twenty years the use of arsenic in some form or other as an insecticide has

been very greatly developed. For use in dips a soluble form of arsenic was desirable and arsenite of soda is now in general use. A soluble form, however, cannot be used on plants, as it is fatal to plant life.

As an insecticide for the protection of plants, therefore, the insoluble arsenate of lead came into general use, and in this form was recommended for the protection of all plant life against biting insects.

A few years ago it was suspected that the use of even arsenate of lead on citrus had a harmful effect on trees, which was indicated by the loss of acidity and general flavour of the fruit. This has now been definitely shown to be the case, and although no trace of arsenic can be discovered in the juice of the fruits even when excessive amounts have been used, there is no doubt that an important chemical change is developed in citrus trees sprayed with arsenic.

The percentage of citric acid is lowered, the quality of the sugars is lessened, and the amount of Vitamin C is seriously reduced. How the arsenic acts upon the tree has not been established, but this discovery suggests new possibilities of determining some of the chemical changes taking place in plant life which have hitherto been difficult to ascertain. The effects on the fruit are sufficiently great to render it unsuitable for export and the use of arsenic in any form on citrus trees should be discontinued.

The Shirley Cotton Institute.—The Shirley Cotton Institute is one of the finest laboratories in England. In spite of lean times in the cotton industry, manufacturers see in scientific research one of the hopes of the future, and subscriptions have kept up well. There is a staff of nearly 200, of which about 70 are fully qualified scientists. The income of the Association is over £53,000 a year, four-fifths of which is subscribed by the cotton trade and the remainder by the Government's Department of Scientific and Industrial Research. Even more impressive is the fact that about 80 per cent. of the cotton manufacturers in the country are members of the Association.

There has been no fundamental discovery of outstanding importance in the cotton industry for many years, but there have been a very large number of small improvements and advances in knowledge which, when added together, reach a substantial total. In fact, it has been suggested that a saving of something like £300,000 a year is being effected in Lancashire by research—a return of 500 per cent. on the money invested.

Empire team-work is well practised in cotton research. The cotton industry stretches right from the sun-baked fields of Uganda or Queensland to the damp, clattering mills in Lancashire, and beyond to export markets. Science has to watch every link in this continuous chain. The Shirley Institute is the only body in the cotton industry with a vertical view—that is to say, it is the only body competent to trace a fault back from one stage of processing to, perhaps, the climate or soil in the country where the cotton was grown, or to some mistake in the ginning, or to damage during transport.

Economic Problems.—The farmers of to-day are faced with an anomalous—it seems almost an impossible—problem, that of reducing the cost of production without increasing the volume of production of some of the staple farm products. The cost of production of manufactured articles has been brought to a high state of efficiency under the stimulus of a constantly increasing demand for their products. The farmer has no such incentive. He knows that there is an over-production of many of his products, and he sees no relief in the near future, for he has to compete in the world markets, and vast areas of agricultural land are being brought into use, and everything that lessens the cost of production or transportation anywhere in the world, except in his own immediate locality, makes his struggle more difficult. His only hope seems to be that possibly he may, by more efficient methods, implements and managerial ability, drive some other farmer out of business and convert him and his family from competitors in agricultural production into consumers of agricultural products. This is being done on an enormous scale throughout the United States at the present time.—(U.S.A. Dept. Ag. Misc. Circular, October, 1931.)

Increased Yields of Potatoes due to Fertilisers.—Bulletin No. 410 of the Wisconsin Agricultural Experiment Station, appropriately entitled "New Science for an Old Art," contains an interesting note about the effect of concentration of fertilisers. Ten loads of farmyard manure per acre applied to potatoes produced a yield of 173 bushels per acre. An addition of 800 lbs. per acre of a 5-8-7 fertiliser resulted in a yield of 253 bushels per acre, an increase of 80 bushels due to the artificials, and costing less than 25 cents per bushel. 400 lbs. (half a dressing) of a 10-16-14 fertiliser (double concentration) gave 251 bushels, an almost identical increase obtained at less cost for the fertiliser and with less labour for handling and distribution. A fertiliser with more potash still further increased the yields without appreciable increase of cost; 800 lbs. of a 3-12-12 fertiliser, given in addition to farmyard manure, produced exactly the same average yield. The report advises that highly concentrated fertilisers should be well mixed with the soil, and should not come in close contact with the seed. The soils in the experiment were loams, and fertilisers were carefully distributed, and there was adequate moisture during the early season.

Bleaching of Pea Nuts.—An interesting and instructive article on the bleaching of pea nuts appeared in the February issue of "Farming in South Africa," and in order to try it out with Rhodesian varieties, experiments were conducted by the Chemistry Branch at the agricultural laboratory in Salisbury, with very satisfactory results.

Four separate samples of nuts from different types of soils, and with varying conditions of colour and cleanliness, were kindly submitted by the Farmers' Co-op., Ltd. These were as follows:—

No. 1.—Yellow.
No. 2.—Dirty red.
No. 3.—Blackened by rain.
No. 4.—Dirty light red.

The active agent employed was a 2 per cent. solution of sodium bisulphite, the compound which has been proved in the Union trials to give most satisfactory results with least damage to the nuts.

The first step in the process was to wash the samples of nuts for five minutes with a soft nail brush in clean water. They were then transferred to a basin containing ten times their weight of the 2 per cent. solution of the bisulphite, and brushed here again for five minutes. The treatment ended by washing in running water for three or four minutes and spreading out to dry in the sun on a large inverted sieve.

Two variations of this method were also tried out. In one no brushing whatsoever was done, the nuts, apart from that, receiving the same treatment as far as concentration of chemical, time of soaking, washing and drying were concerned. In the other, brushing was resorted to in the water, but only stirring with a wooden rod in the bisulphite was given.

The results where brushing at one or both stages was a part of the process were excellent and produced nuts perfectly clean and with their original and normal sheen unblemished. There was little, if anything, to choose between the final products of those which had been brushed only once and of those which received two brushings, but the non-brushed samples were so little improved that it is evident that brushing, whether once or twice, is an essential part of the treatment. Washing alone without brushing does not remove the minute particles of soil adhering to the innumerable little pits in the shell, and the latter continues to look dirty in appearance.

No injurious effects are left upon the nuts; the time (five minutes) is too short for the weak solution of bisulphite to penetrate the shell, and chemical tests verified that the last trace of it had been removed by the final washing in running water.

This method was quite ineffective with the third sample consisting of nuts blackened by rains, and it is highly improbable that these could ever be cleaned owing to the changes that have taken place in the shell tissues due to the moisture absorbed. It was also ineffective with shell-broken nuts, but these in any event would be unfit for export purposes.

It should not be too difficult or too costly to apply this method on a large scale. Although not tested out in the course of these experiments, the same solution of sodium

bisulphite, according to the writers of the article above mentioned, can be used 15 times or oftener for the treatment of the nuts. Now 1 lb. of nuts requires 10 lbs. of a 2 per cent. solution of the bisulphite, i.e., 100 lbs. nuts require 20 lbs. of the solid. The wholesale price in England is approximately 9d. per lb., which would mean 15s. per 100 lbs. of nuts, but as the solution can be used 15 times, the cost of the chemical is roughly 1s. per 100 lbs. nuts.

Although the whole process could be carried through by means of broom brushing by native labour in large wooden or cement tanks, it is considered that, although much more costly, of course, some form of mechanical rotary brush arrangement would be preferable, giving greater efficiency and convenience. Perhaps it would be advisable to try out the method on a large scale in the first place with brooms, and consider the rotary brushes if the former were successful, which, given proper supervision, it ought to be.

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

PESTS OF STORED TOBACCO IN SOUTHERN RHODESIA.

By M. C. Mossop, M.Sc., Entomologist.

INTRODUCTORY.

The problems associated with the presence of insect pests in stored tobacco have been investigated in Southern Rhodesia during the last few years. Owing to the accumulation during 1928-29 of surplus stocks of Empire tobacco in London, including some 17,000,000 lbs. of Rhodesian tobacco, a heavy fall in prices occurred, which was accentuated by the discovery in 1929 in the warehouses there, and in baled tobacco, of the stored tobacco worm, *Ephestia elutella*, Hubn. (Figs. 1 and 2). This insect is overseas primarily a pest of other stored products, especially cacao beans and peanut (*Arachis*) products. The first record of its presence as a serious pest of stored tobacco was reported in 1928 from Bulgaria. It was later found in leaf and other tobacco, including the Rhodesian product stored in the London bonded warehouses. In August, 1930, it was found infesting tobacco in the United States.

The original source of the pest in Rhodesian tobacco stored in London could not be traced definitely, but over two years ago it was found in tobacco from this Colony on its arrival in London. At the same time careful search failed to reveal the pest in Southern Rhodesia or Beira, and it was not until April, 1930, that a few specimens were found in imported chocolate, and finally, in June, 1930, on stored tobacco in Salisbury. As long ago as 1915 this insect was recorded as a pest of peanuts in Nyasaland.

The cigarette beetle, *Lasioderma serricorne*, F. (Figs. 3 and 4), or the tobacco "weevil," as it is sometimes called, has been present in this Colony for a number of years, and is a cosmopolitan pest. This insect also feeds on stored products other than tobacco.

In order to ensure that tobacco exported overseas from Southern Rhodesia would be as free from pests as reasonable preventive legislation could contrive, and thus to regain the confidence of overseas buyers and thereby raise the market value of our tobacco, the Tobacco Pest Suppression Act was passed in 1931. This Act provides for the licensing of all premises where unmanufactured tobacco is prepared or held for export, for the inspection and cleansing of all such warehouses and for the destruction of infested tobacco where necessary. The provisions of this Act and the regulations published thereunder are of importance to all tobacco growers.

Public interest in pests of stored tobacco has now been aroused, and the following information on the biology and suggestions regarding avoidance and control of the two principal pests are given below.

EPHESTIA ELUTELLA.

Ephestia elutella, Hubn., is known overseas as the cacao moth, cacao bean moth and chocolate moth. In Southern Rhodesia the insect is known only as a pest of stored tobacco at present, and as it is desirable that its common name should be associated with that commodity, the name "stored tobacco worm" is suggested. The group of insects to which it belongs includes many well-known pests of stored products.

THE MOTH.

If a warehouse is infested, close examination during late spring and summer of the walls and ceilings and any baled tobacco that may be present will usually result in the discovery of the adult moths, but during the late winter and early spring the closest examination may fail to disclose any. The moth has a predilection for dark corners, and when disturbed will often fly about for half a minute or more without moving far from its original position. When the moth alights the wings are folded close to the body, and the body is usually held at an angle to the surface upon which it rests with the head pointing away from this surface. The habit is, however, by no means peculiar to *E. elutella*.

The moth (Fig. 1) with wings folded measures about $\frac{3}{8}$ in. from the head to the tip of the wings, and with wings

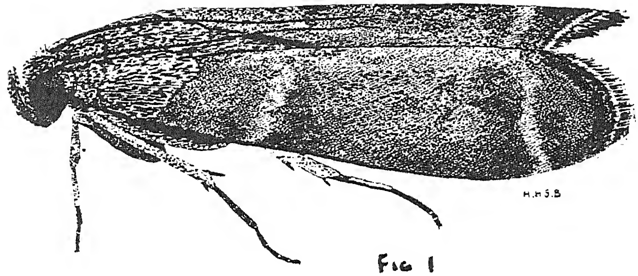

Fig 1

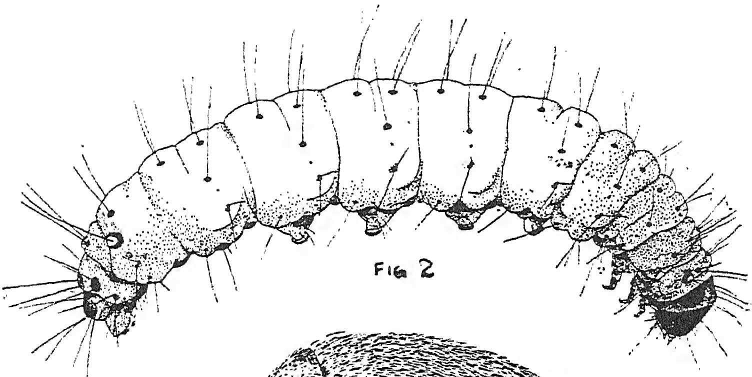

Fig 2

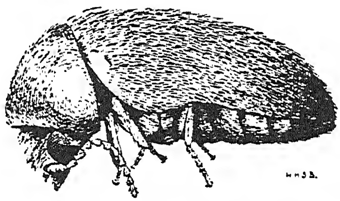

Fig. 3

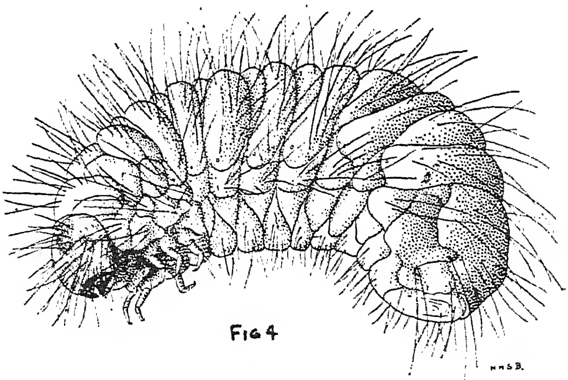

Fig 4

Fig. 1. *E. elutella*, adult, enlarged. After Bovingdon.
Fig. 2. *E. elutella*, larva, enlarged. After Bovingdon.
Fig. 3. *L. serricorne*, adult, enlarged. After Bovingdon.
Fig. 4. *L. serricorne*, larva, enlarged. After Bovingdon.

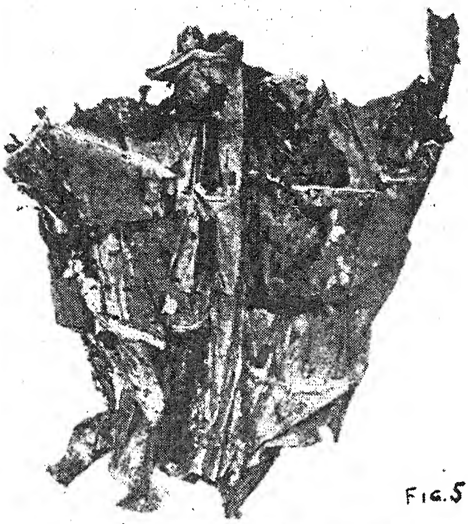

FIG. 5

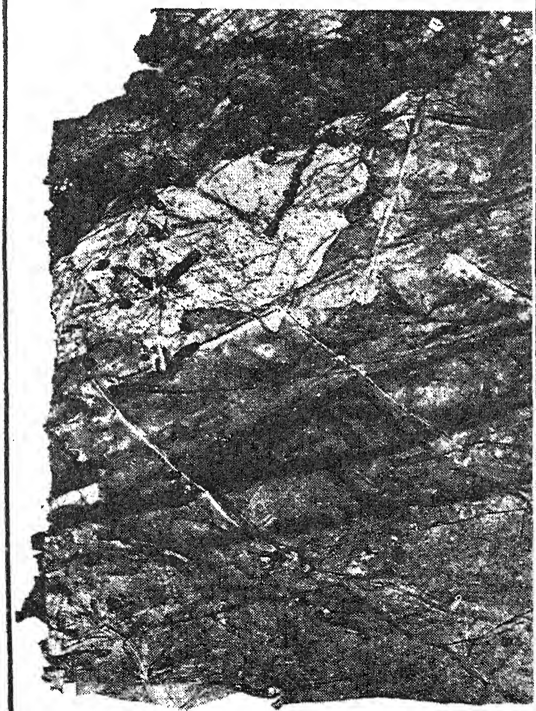

FIG. 6

Fig 5. Tobacco showing feeding damage and frass of E. *elutella*, natural size.

Fig. 6. Tobacco showing tunnelling of *L. serricorne*, natural size.

spread out, $\frac{5}{8}$ in. to $\frac{3}{4}$ in. from tip to tip. The colour of the forewings and body of a fresh specimen is a fairly dark brownish grey, the brown being slightly more pronounced in lighter coloured specimens. There are two light bands across each forewing, the inner one being straight and transverse and the outer one sinuous like an almost straightened, reversed "S" and only slightly transverse. Older specimens, or those kept in captivity, lose many of the wing scales and appear a much lighter grey, often showing a dark border to the original white lines, which have become invisible. The hind wings are of a uniformly light brownish grey with a thin dark line on the margins (except the front), edged with a thin white line. The antennæ are thread-like and delicate, and when at rest lie backwards over the body.

Food is apparently not essential to the moth, although it will suck up water and probably other liquids. The purpose of the adult appears to be to reproduce and disseminate its kind. The moth may mate and the female lay eggs soon after emergence from the pupal stage, but, in captivity at any rate, the bulk of the eggs laid by a mated female appear from the second to the fourth day. Egg laying may continue for at least eight days, and a total of 97 eggs have been obtained from one mated female in Salisbury. Observers overseas have recorded more than twice this number. The percentage of fertile eggs has not been ascertained. Unmated females have laid up to 60 eggs each, all of which have failed to hatch. The moth, both male and female, lives for about twelve days or less.

THE EGG.

The egg is oval in shape with a somewhat warty and wrinkled surface, and dull cream in colour. The colour darkens slightly with age. The length varies from 1-55 to 1-40 in., and the width is from half to two-thirds the length. Eggs are laid singly on the tobacco or on the hessian covering of the bale, although a group of several individual eggs may sometimes be found scattered in a small area. Hatching occurs in five to ten days according to the temperature.

THE LARVA.

The newly hatched larva or caterpillar is small, yellowish white, and with a thin body and comparatively large head.

The distance it can crawl is not known, but when confined in a tube without food it crawls about for many hours. The young larva exhibits cannibalistic tendencies, preferring the dead bodies of the adults or of other insects to tobacco as food. This diet, however, is not a necessity, for the dead adults have usually been removed from the rearing jars before the eggs have had time to hatch.

The caterpillar (Fig 2) possesses three pairs of thin, articulated legs on the first three segments near the head, and four pairs of thick, fleshy false legs on about the middle third of the body and one pair on the last segment. The body of the growing caterpillar is pinkish in colour, changing when full grown to a yellowish white. The head is brown, and immediately behind is a pair of brown plates. A lighter brown plate occurs on the last segment of the body. The caterpillar is clothed with sparse hairs, the individual hairs arising from small, dark brown spots which give the caterpillar a characteristic appearance. The full-grown caterpillar is about $\frac{3}{8}$ to $\frac{1}{2}$ in. long.

Feeding Period.—When reared in Salisbury on Rhodesian flue-cured bright leaf tobacco, the larva feeds usually for about two to three months. It then commences to wander about in search of a suitable crevice, preferably away from the tobacco, in which to spin up and rest or pupate. A strong tendency to climb is exhibited by the wandering larva.

In rearing the insects the writer has taken advantage of these habits and has been able to obtain the larvæ as soon as they have left the tobacco by placing strips of corrugated cardboard inside the tops of the rearing jars. When a larva has ceased to feed it wanders about inside the top of the jar and eventually enters a crevice in the cardboard. The difference between the date of hatching and the date on which the fully fed larvæ have been found (commencement of the larval resting period) has been taken as the duration of the feeding period. Based on observations of behaviour, suitable precautions have been taken to ensure that no larva recorded as having fed for a long period has been hiding fully fed in the tobacco during a portion of the time recorded.

By this method, feeding periods of 40 to 198 days have been recorded, with about 60-90 days as the normal under

favourable conditions. The larva is not necessarily feeding during the whole of this time, as it may possibly become inactive at low temperatures and continue to feed when its surroundings become warmer.

Larval Resting Period.—The wandering larva soon settles down and may or may not spin a flimsy, white cocoon. When it has thus settled, it usually remains motionless and may pupate within a few days, or may remain *in situ* as a larva for a few weeks or months.

The length of the larval resting period varies even more than that of the feeding period. The resting period is here reckoned as the time between cessation of feeding and commencement of pupation, and varies from three days to ten months. The latter record is not absolutely reliable, as the insect concerned died just when its behaviour indicated imminent pupation. However, some reliable long larval resting periods recorded are seven and over nine months. The normal period under favourable conditions is from a week to a month.

Temperature appears to be a main factor controlling this period. This may be seen in records of individuals that ceased to feed in autumn and winter. Out of 27 larvæ hatched in early January, 1931, the individuals of which ceased to feed between March and July, 4 had a larval resting period of under 51 days, 9 rested from 51 to 100 days, 11 from 101 to 150 days and 3 from 151 to 195 days. Similarly, of 22 larvæ in a generation hatched in early March, 1931, the individuals of which ceased to feed in May and June, none had a larval resting period of under 51 days, 14 rested from 51 to 100 days and 8 from 101 to 131 days. Nearly all the individuals of these two more or less parallel generations pupated during the latter half of August or the first half of September when warm weather set in. Mass pupation thus occurred at a period of low humidity and high evaporation, but the vital factor influencing pupation during these months appears to be almost entirely connected with a rise in temperature. Breeding experiments with controlled humidities have not been carried out.

The above observations are substantiated by the fact that in a local cigarette factory mass pupation took place during

August and September, after which only a negligible number of fully fed larvæ were seen until December, when larvæ of a new generation were taken. Further evidence of the effect of temperature was obtained when of 35 larvæ taken from the same environment on 1st July, 18 were kept at ordinary room temperature and 17 in a heated room; 70 per cent. of those in the heated room pupated and emerged during July and August, while none at room temperature emerged before September.

There is evidence, however, of the existence of an unidentified factor also influencing the length of the larval resting period.

The above figures indicate that the total larval period may vary considerably and extend over long periods. Records of total larval life vary between the extremes of 44 days and 365 days in Salisbury.

Damage done to Tobacco by the Larvæ.—The larva attacks almost any kind of bright flue-cured tobacco, but has not been recorded as a pest of fire-cured leaf. It feeds on any part of the leaf except the veins, making irregular-shaped cavities in baled tobacco (Fig. 5). These cavities are often partly filled with dark brown particles of fæces held together in bunches of various sizes by threads of silk spun by the caterpillar. The bunches of excreta are dark brown to black in colour, their presence giving an unsightly appearance to the tobacco. The excrement is, as a rule, more quickly noticed than the actual damage to the leaf. That of the young caterpillar is light brown, but of the older ones dark brown to black, but light brown at one end, blunt at both ends and usually slightly waisted in the middle.

Food of the Larva.—The stored tobacco worm has been described overseas as being catholic in its tastes, having been known to attack a very wide range of stored products, including cacao beans, cacao powder, chocolate, cured tobacco in various forms, many kinds of seeds, dried fruits, peanuts and peanut products, shelled walnuts, pearl barley, linseed and flax-seed meal, sugar beet, garlic roots, stored flour, army and dog biscuits, bread, cakes, sugar, dried vegetables, rice, coffee, red and cayenne pepper and dead insects.

Parasites of the Larva.—The prolongation of the larval stage is one of the weak phases in the life history of the stored tobacco worm, as it affords increased opportunities for the attacks and multiplication of a small parasitic enemy, *Microbracon hebetor*, Say. This insect, after stinging its prey to produce a condition of paralysis, lays eggs on the skin of the now inactive and defenceless caterpillar. After hatching, the young parasitic wasp grubs remain on the outside of the caterpillar feeding on its tissues for about a week before they become full-grown. They then spin neat, white, oval, silken cocoons on the caterpillar, or perhaps, more often, a few inches away from it, and pupate. The adult emerges in a few days, and as many as thirteen adult parasites have been reared in Salisbury from one larva of the stored tobacco worm. It frequently happens that a female parasite will sting a caterpillar without laying eggs on it. Such caterpillars eventually die, although they may live for several days, as indicated by the beating of the heart. A stung caterpillar, whether eggs have been deposited on it or not, may be recognised by its inactivity and flaccid unhealthy appearance. As paralysis in the caterpillar is produced soon after the insect is stung, paralysed larvæ may often be seen fully exposed on walls, etc., over which they have been wandering when attacked.

THE PUPA.

Pupation of the stored tobacco worm usually takes place in a flimsy, silken, whitish cocoon. Sometimes, however, there is no cocoon; at others the silk is so thickly spun that a tough cocoon is formed. When the caterpillar spins up in a crevice such as a nail hole the cavity is lined with silk and a silken barricade spun over the entrance. Frequently a hole is left in this barricade and may be used by the moth as an exit, or by parasitic enemies reaching or leaving a victim. Before pupating, the larva assumes a sickly white colour, giving the impression that the insect is diseased. A final ecdysis or shedding of the larval skin occurs, and a pale cream-coloured pupa is formed. The colour gradually darkens through amber to almost black, the wings showing up darker than the body. The dark colour observed is really that of the fully developed moth as seen through the thin, semi-trans-

parent amber pupal case. On completion of metamorphosis the moth becomes active inside the pupal case, and the latter splits at the head and down the ventral surface. The adult moth emerges, casting off the pupal case, and forces its way out of the cocoon. Immediately after emergence, the moth rests for a short time while its wings are expanding and drying. After about twenty minutes this process is complete and the moth is able to fly away.

The period of pupation has varied in Salisbury from 9 days in early summer to 50 days in mid-winter. The usual period is about 10 to 20 days in summer and 18 to 28 days during the time of mass pupation in spring.

EXPERIMENTS WITH *E. ELUTELLA*.

A number of preliminary experiments in control have been carried out with a view to obtaining data on which further tests may be based. Owing to the unpromising nature of the results obtained and in some cases to lack of opportunity these tests have not been repeated. The experiments were made possible through the kindness of the staff of a local cigarette factory who provided the necessary facilities. The details and results of the tests carried out to date are given below, the objects of the individual tests being evident from the statement of results. Tests (2) to (13) were simultaneous.

(1) Exposure of three batches of eggs to a temperature of 133 deg. F. for five minutes in a tobacco drying cylinder in normal operation. The temperature recorded was that of the cut tobacco on removal from the cylinder. No exposed eggs hatched; 21 out of 23 control eggs hatched.

(2) Three balloon fly traps set with a bait of unsweetened chocolate for 12 days. Total catch, one adult female.

(3) Two sheets of home-made fly paper each ten inches square, with chocolate incorporated in the sticky material (adhesivity fair), placed on top of stacked bales for 12 days. Total catch, eight moths, five larvæ.

(4) Two sheets of plain, home-made fly paper (adhesivity good), each ten inches square, placed on top of stacked bales for 12 days. Total catch, 64 larvæ.

(5) Two papers, each ten inches square, smeared with melted chocolate and left on bales for 12 days. No eggs deposited.

(6) Two papers, each ten inches square, smeared with a mixture of chocolate and water, dried, and left on bales for 12 days. No eggs deposited.

(7) One pan, ten inches square, smeared as in (5) and left on bales for 12 days. No eggs deposited.

(8) One pan, ten inches square, smeared as in (6) and left on bales for 12 days. No eggs deposited.

(9) One pan, ten inches square, containing chocolate powder, left on bales for 12 days. No eggs deposited.

(10) One pan, ten inches square, containing chocolate and water left on bales for 12 days. Catch, 6 male and 5 female moths.

(11) One pan, ten inches square, containing water left on bales for 12 days. Catch, 19 moths, sex not identified.

The positions of (10) and (11) were interchanged several times.

(12) One pan, 6 ft. by 1 ft., containing water left on top of stack for 6 days. Catch, 53 male and 5 female moths.

(13) One pan, 6 ft. by 1 ft., containing water left in a space in middle of stack for 6 days—simultaneously with (12). Catch, 22 male and 20 female moths.

(14) Three strips of corrugated cardboard, each 1 ft. long and $\frac{3}{4}$ in. wide, tacked horizontally on a wall with three feet of floor space between the wall and some stacked bales, and left for two days. Catch, 5 larvæ.

(15) Forty feet of corrugated cardboard strips (33 feet horizontal and 7 feet vertical over an obstacle) tacked along a wall parallel to a row of stacked bales and three feet therefrom, and left for 12 days. Catch, 13 pupæ, 158 larvæ. The larvæ were heavily parasitised by *M. hebetor*. This catch is equivalent to a catch of 1.3 larvæ per horizontal yard per day.

Further catches were made on the same site, and the results are given below in terms of the average number caught during a portion of each month per horizontal yard of corrugated cardboard per day:—

April, 1931 (as above)	1.3
July	0.43
August	0.34
September	0.02
October-November	0.01
November	0.03
December	0.21
January, 1932	0.27
February	0.52

The sudden drop in the number caught in September is accounted for by the occurrence of mass pupation of larvæ on the arrival of warm weather in late August and September. The sudden rise in December is considered to be due to migration from the bales of fully-fed larvæ of the new generation bred from the moths that emerged in spring. Rearing experiments in the laboratory confirmed the foregoing conclusions.

LASIODERMA SERRICORNE.

Lasioderma serricorne, F., is known under a number of popular names, such as cigar beetle, cigarette beetle, tobacco beetle, and sometimes tobacco weevil. It is not a true weevil (Curculionidæ), but belongs to a family of beetles (Anobiidæ) which live chiefly on dried vegetable matter, including timber.

The tobacco beetle is known primarily as a pest of some form of cured tobacco, but it is also a serious past of ginger, copra, and copra cake. It has been recorded from over seventy stored products, including rice, raisins, rhubarb, cayenne pepper, dried fruit, coffee, ergot, dried beans, cumin seed, stored pulses, turmeric, liquorice, dates, chick peas, spices, belladonna, saffron, cane work, vegetable material in upholstery, cotton bolls, dried drugs, seeds, books, leather, insect powder, and strychnine!

THE BEETLE.

The adult beetle (Fig. 3) is of a brown to reddish brown colour, and is $\frac{1}{8}$ to $\frac{1}{10}$ in. long. The size varies considerably. The head and prothorax are usually seen bent downwards in a characteristic attitude as in Fig. 3.

It is not known to attack growing tobacco in the field, although it has been reported in Nyasaland as breeding in the field in old, shrivelled cotton bolls previously attacked by cotton stainers and other insects. The beetle is slightly attracted to light and may be caught in fair numbers, in relation to the infestation, on windows in warehouses. It is a moderately strong flier and is especially active in the late afternoon.

The adult can bore its way out of containers of paper, cardboard, and other materials, but it is doubtful whether it eats its way *into* such containers. The evidence produced by the examination of a number of perforated cigarette boxes strongly suggests that the holes were made from the inside. A series of tests has been carried out to demonstrate whether the beetle can bore its way through to tobacco securely sealed in bags of ordinary brown paper or bags of tarred paper as used for wrapping bales. In no case was a bag perforated by the beetle.

Reverse tests, in which infested tobacco was packed in sealed bags and kept under bell jars, showed that the beetles could bore their way out, though they were able to find, and preferred to use, holes already made by erstwhile fellow prisoners. This is in keeping with the findings of Zacher, whose work with the grain weevil *Sitophilus (Calandra) granaria*, L., is referred to by Richards as follows:—"He found that beetles shut up in various types of cartons, whether given food or not, always eat their way out. On the other hand, beetles enclosed in a glass vessel with food only available inside a carton never eat their way into it but die of starvation."

Copulation may take place soon after the beetles emerge from the pupal cells, the fertilised female laying from 25 to 30 eggs over a period of about three weeks. The eggs are usually deposited in the folds of the leaves, in the exposed butts of the hands in the bales, or in the ends of cigarettes or cigars. In Salisbury the beetles of the first brood, which normally emerges in September and October, commence to lay eggs immediately. Subsequently the broods overlap to a large extent. The beetle may live for five to six weeks normally, but much longer in winter.

THE EGG.

The egg is white, about 1-50 in. long, with a smooth, toughish shell, and is deposited in situations as described above. Hatching occurs in from six to ten days.

THE LARVA.

The newly hatched larva is a small, whitish, hairy grub. It can crawl short distances, but as a rule soon settles down to feed. The grub ceases to migrate after it has commenced to feed, its movements probably being confined to a few cubic inches of tobacco. Feeding activities result in the characteristic tunnels seen in Fig. 6, in which the tunnels are shown both in cross and longitudinal section.

The grub (Fig. 4) is usually found in a curled attitude, the abdomen being bent round almost double. This attitude is struck when the insect is disturbed. The full grown grub measures about $\frac{1}{6}$ in. long. The head is brown and the body yellowish white, with three pairs of jointed legs behind the head. The body is covered with numerous moderately long hairs as shown in Fig. 3, which collect and carry a certain amount of frass and tobacco dust. The excrement is dark brown to black, roughly barley shaped, being more or less pointed at both ends. The grub normally feeds for two to three months in Salisbury, shedding its skin several times, and then constructs from the surrounding debris a smooth-lined cell in which to rest. This cell is constructed at or near the site of feeding.

Then follows a period of rest which may vary from a week in favourable weather to several months during autumn and winter. About 50 larvæ under observation in Salisbury commenced their rest in mid-April, and did not pupate until mid-September—five months. The larval stage is the common hibernating stage of the insect.

THE PUPA.

Pupation does not occur immediately after the cell has been constructed, the grub remaining quiescent for about one week under optimum conditions of temperature;

but under unfavourable conditions this resting period may be prolonged several months. As soon as conditions are favourable the grub gradually takes on the pupal form, at the same time contracting to about $\frac{1}{8}$ in. long. The new pupa is glossy white, but gradually turns a reddish brown after a few days. The legs, wings, eyes, and other external features of the adult can be recognised in the pupa. The period of pupation varies from six to ten days, after which the adult may remain in the cell for two days or so before emerging.

ENEMIES.

Enemies of *L. serricorne* in Southern Rhodesia consist of at least one small hymenopterous parasite, and a species of mite. The hymenopterous parasite has not been identified, nor has its life history been studied. The mite is the cosmopolitan, predacious *Pediculoides ventricosus*, Newp., which has been observed to kill many larvæ and papæ. It has been seen mostly in the cells in which the larvæ rest and pupate. The males and uninflated females are very small, but visible to the naked eye. The gravid female, however, becomes inflated with young, and has the appearance of a yellowish pearl about the size of a pin's head.

PRECAUTIONARY MEASURES.

The Department of Agriculture has for some time been urging tobacco growers and managers of tobacco warehouses to observe scrupulous cleanliness, during the spring and summer months especially, in regard to rooms, barns, stores, etc., where tobacco is stored or handled. The wisdom of having no tobacco whatsoever in or near the premises is recognised, but cleaning up is usually not practised with sufficient thoroughness to render it as effective as it should be. Both the cigarette beetle and the stored tobacco worm require but a small amount of cured tobacco to bring them to maturity. Cracks in floors, spaces under wooden floors or between bricks near the floor, many cracks and crevices in the press itself and around its foundations, each and all are liable to harbour scraps of tobacco sufficient to support a population of pests over the spring and summer months.

Although the duration of the life cycle of both these tobacco pests is normally somewhat extended during the autumn and winter months, the artificial temperature and humidity maintained in the grading sheds at this time afford favourable conditions for continued emergence and breeding of these insects. Thus the new crop may become infested soon after it is brought in from the barns.

As a result of the first season's inspection of tobacco warehouses under the "Tobacco Pest Suppression Act, 1931," it was found, as was expected, that warehouses that had received thorough cleaning after early disposal of all tobacco —saleable and waste—were free of pests. However, the inspectors were nearly always able to find a few scraps of tobacco on the premises, and it would appear that the comparative isolation of farm warehouses in which tobacco pests have not yet been discovered is an important factor in their freedom from pests. The benefit of isolation will be lost, at least temporarily, once the warehouse becomes infested.

The Tobacco Pest Suppression Act indirectly affects all growers. If they do not themselves export, their tobacco is usually consigned to an exporting warehouse, and if pests are found the grade is considerably reduced or the consignment is refused. On account of the danger of their licences being suspended, owners of commercial warehouses and grading establishments will regard with disfavour any infested or old tobacco, whether it be for export or for distribution within the Colony. This attitude of buyers and their agents is justified. Richards, writing of the possible troubles of a chocolate manufacturer, states that "a single moth or beetle flying from a cacao-store and laying its eggs in a box of chocolates just before they are sealed up may cause the makers more trouble and expense than the combined activities of 2,000,000 larvæ attacking the cacao beans."

It therefore behoves all growers and other persons handling unmanufactured tobacco to adopt the following precautionary measures, some of which are enforced under the Act:—

(1) **Speedy Disposal of Crop.**—Immediately packing has been completed, consign all the saleable tobacco to its destination. Any scrap or other loose tobacco that is to be

kept for native consumption should be stored as soon as it is sufficiently dry in an air-tight tank. The lid of the tank can be made sufficiently air-tight by inserting a large rubber gasket made of an old inner tube of a motor car tyre. A large petrol drum can be used if a hole is cut at one end, and an over-lapping lid, made of sheet iron, suitably weighted or clamped down on a rubber gasket, over the opening. The tobacco thus stored can be fumigated conveniently with carbon bisulphide at the rate of about half a whisky bottle (13 fluid ounces) per 100 cubic feet of space enclosed by the tank. This high concentration should only be used for fumigating infested tobacco, as at this strength injury may be caused to certain other products, especially seeds and plants. The amount given is a somewhat arbitrary one, but is based on sound principles of fumigation. The quantity required for a 44 gallon petrol drum is approximately 1 fluid ounce, at present prices costing about 1½d. for each fumigation. Tobacco kept for making insecticide should be stored in the same way.

The practice of keeping tobacco for use as a fertiliser is not advocated. Tobacco kept for this purpose endangers the cleanliness of store rooms from the pest control aspect and may constitute a source of disease in the fields. If it is burned immediately and the ash kept for use when required, these dangers are eliminated. But it has been indicated in tests of a preliminary nature made by the Department that this system is not practicable owing to the meagreness of beneficial results. However, if the tobacco is thoroughly mixed with manure and quickly rotted down, the danger of encouraging pests and spreading disease may be avoided.

If saleable tobacco must be stored it should be baled, and each bale wrapped in a single sheet of brown paper impregnated with tar, this wrapping being under the hessian covering. All places where the paper overlaps should preferably be sealed with an adhesive. Considerable protection from pests is thus afforded, but the possibility that the tobacco may already be infested should not be overlooked. Bales of tobacco wrapped in tarred paper should be handled with care, otherwise the paper wrapping may be torn and the protection from pests diminished.

Pay strict attention to the speedy disposal of tobacco scrap, etc., outside the buildings or stored in neighbouring sheds. Scrap should be burnt or disposed of as it accumulates, that is, while grading is in progress, instead of waiting until the end of the season.

(2) **Thorough Cleaning of Premises.**—After the tobacco has been disposed of, a thorough clean-up of the premises is necessary. A good sweeping giving the appearance of cleanliness is insufficient.

(a) Sweep walls and clean out all crevices. Where no danger to the building is entailed, the tops of the walls should be treated with a blow-lamp in order to kill insects hiding there. Similar treatment may be given to suspicious-looking crevices in the walls and roof. Unplastered or unpointed walls afford excellent hiding places for pests.

(b) Overhaul and clean all equipment thoroughly, scraping the dirt out of the crevices. Scraps of tobacco lying underneath the press are often overlooked and should be removed.

(c) Scrape out with a pointed instrument all the crevices between boards in wooden floors. Where holes are present a quantity of tobacco always collects under the floor boards. If necessary, some boards should be taken up and proper cleaning below the floor carried out. All holes in the floor should then be properly closed up, holes that admit piping, etc., not being overlooked.

(d) In short, ensure as far as possible that not a scrap of tobacco on which pests can feed remains on the premises.

Tobacco refuse, etc., deposited outside the warehouse should be totally consumed by fire or otherwise disposed of to render it unfit for consumption by insects, and the surroundings properly cleaned up.

(3) **Lime-washing Walls.**—After all tobacco and debris have been disposed of, spray the walls with hot lime-wash. A bucket pump with a long hose is useful for the purpose if equipment with a long spray rod is not available. Apply the spray with the highest pressure attainable. The lime-wash recommended at present is made by mixing quicklime gradually with water, the amount of quicklime used being

about one-third of the volume of the amount of wash made. About a pound of salt should be included in every ten gallons of spray; a little laundry blue will improve the appearance. Use the spray while it is still hot from the reaction, or, if allowed to get cold, heat it again over a fire.

(4) **Storage of other Products.**—Do not store other products in the shed during the off season, especially peanuts and peanut meal or cake. It is feared that the peanut and its products might become a favoured food of the stored tobacco worm in this country, as they are known to be elsewhere. At present in most warehouses the avoidance of pests of stored tobacco is a simple matter if proper attention is given to the precautions given above. If in the future, however, these pests develop the habit of living on products which cannot conveniently be excluded for the greater part of the year from the farm or the vicinity of the warehouse, the problem of control will become much more serious. The writer has already found one adult moth specimen of the stored tobacco worm in a private house in Salisbury, though its origin was not discovered. In this connection the farm housewife might help. Let her look to her pantry and see that no insects escape. Screened doors and windows are useful both for ventilation and for helping to keep insect pests from damaging the products of the farm. A pan of water on one of the shelves of the pantry will catch a number of insects breeding in that room.

At least a dozen pests destroying stored tobacco have been reported from various parts of the world, in addition to insects secondarily infesting this product. These latter are mostly pests of other stored products which might find their way into tobacco, and by their presence lower its value. One commonly met with is a flour beetle, *Tribolium castaneum*, Hbst., found in many kinds of meal, and, in association with other pests, in grain. Attempts to rear this insect on tobacco leaf and powdered tobacco in Salisbury have failed.

Recent experiences with the stored tobacco worm will influence buyers to suspect any insect seen on a tobacco

bale of having injured that bale, and of being capable of doing further damage.

CONTROL OF INFESTATIONS.

Starvation.—The problem of eradicating pests from an infested warehouse or from infested bales of tobacco presents many difficulties. Complete disposal of all tobacco and other likely foods of the pests, followed by absolute cleanliness for a full year, will in theory, and probably in practice, ensure eradication. This, however, is only possible in special instances.

Heat.—In those warehouses where Proctor machines are used, if tobacco is put through the machine on arrival and immediately packed and papered on leaving the machine, the tobacco can be considered to be completely free of pests. Where there is danger of re-infestation the bales should be disposed of as early as possible, or stored in an insect-proof room immediately after packing.

Many grading warehouses have a drying room in which fairly high temperatures are attained. Their use, however, in many cases is dependent on the condition of the tobacco. Where a temperature of 150 deg. F. is maintained for two hours in the drying room there should be no danger of tobacco pests remaining alive, whether in the egg, larval, pupal, or adult stage, and probably half-an-hour at this temperature would be sufficient after the tobacco has become properly heated throughout.

An infested warehouse can be cleansed and permanently kept clean if a system of steam heating be installed. If the temperature in the warehouse be raised to 125 deg. F. and maintained for twenty-four hours or longer (e.g., Saturday night to Sunday night or Monday morning), all insect life in the warehouse with the possible exception of insects hidden deep in bales, etc., will be killed. This method is probably not suitable for use in the case of baled tobacco—the time required for the heat to penetrate into the bales is not known and in any case such treatment may cause the moisture content of the tobacco in different parts of the bales to vary, or to interfere in other ways with the quality of the tobacco.

This method is practised in many flour mills overseas, exhaust steam being utilised for heating purposes where steam power is employed. It has been found that one square foot of radiating surface is sufficient to heat 60 to 90 cubic feet of space to the required temperature.

As compared with fumigation, heating is cheap once the initial cost of installation has been met. Thereafter, the products of the farm are used and elaborate and costly preparations for each treatment are not necessary. Treatment "for safety's sake" can be made without undue worry over costs. There is no danger to life and the heat will penetrate to some places where poison gas will not.

Fumigation.—The fumigant mostly used against pests of stored tobacco in Southern Rhodesia is Hydrocyanic Acid Gas produced by the "Zyklon" method or by the pot method. For warehouse fumigation the usual household dosage is recommended. For pests in baled or bulked tobacco in a properly closed chamber the present recommendation is eight to ten times this amount, *i.e.*, at least one "1200 gram" tin of Citrus Zyklon, or 100 ounces of Sodium Cyanide with the requisite amounts of Sulphuric Acid and water, for every 1,000 cubic feet of space enclosed by the walls of the chamber. Fumigation should continue for at least 48 hours. The fumigation of bales or bulked tobacco not in a special chamber is not advised.

Overseas other useful fumigants are used, but are either not in favour or not obtainable in this Colony. For occasional fumigations it is advisable to secure the services of an expert fumigator, from whom an estimate of the cost can usually be obtained before the actual fumigation is undertaken. Where fumigation is to be carried out as an annual routine measure, full information can be obtained on application to the Chief Entomologist.

Table Summarising Differences between the Stored Tobacco Worm and the Tobacco Beetle.

The following table, summarising some differences between *E. elutella* and *L. serricorne*, is modified from Bovingdon:—

Stored Tobacco Worm.	*Tobacco Beetle.*
Egg.—	
Dull white and warty; 1-40 in. x 1-80 in.	Pearly white and smooth. 1-55 in. x 1-128 in.
Larva.—	
Three pairs typical jointed legs and five pairs modified legs with circlet of hooks.	Three pairs typical jointed legs only.
Yellowish-white with inconspicuous dark spots; not very hairy.	Yellowish-white and very hairy.
$\frac{1}{2}$ in. long when fully grown.	1-6 in. long when fully grown.
Excrement distinctly pellet-like, slightly waisted, blunt.	Excrement like tobacco dust, roughly barley-shaped, pointed both ends.
Larva spins silken thread.	Larva spins no silken thread.
Larva does not curl up when disturbed.	Larva curls up when disturbed.
Pupa.—	
About $\frac{1}{2}$ in. long; generally found in folds of hessian or in crevices in casks, floor and walls.	About 1-6 in. long; generally in a pupal cell in tobacco.
Adult.—	
A typical moth; 5-8 in. across wings; dark grey or brownish-grey.	A typical beetle; 1-8 in. to 1-10 in. long; reddish-brown in colour.
Damage.—	
Irregular feeding over leaves like an ordinary caterpillar; presence of unsightly frass.	Galleries circular in section and bored through tobacco in all directions.

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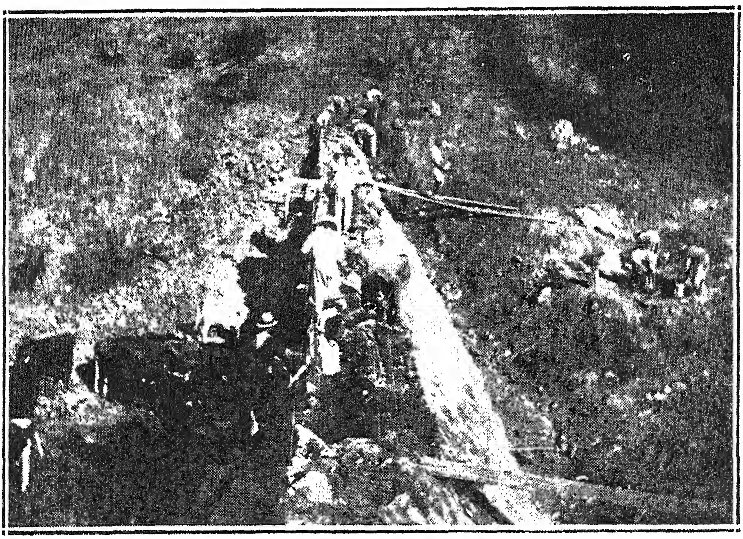
THE BUILDING OF A SMALL STORAGE DAM.

By NEVILLE JONES.

Having recently completed the erection of a small storage dam at Hope Fountain, I think it not unlikely that a short account of the work and its cost may be of value to others who are contemplating something similar. The rain water from a wide catchment area near the Mission Station at Hope Fountain has for many years flowed through a narrow gap in an ironstone hill and millions of gallons of water have been wasted annually. For some time past it had been my desire to erect a dam which would conserve this storm water and so provide the station with an adequate supply of water for irrigation and other purposes. A grant of £500, based upon an expert estimate, was generously made by the Arthington Trustees in England, a body particularly interested in mission work in Africa, and the work was put in hand.

The first step taken was to enlist the services of the Government Irrigation Engineer, who very kindly gave considerable time and thought to the scheme. He recommended a masonry dam of plain gravity section, which he considered would be very little more expensive and much more satisfactory than a rock-fill dam, and the cost was estimated at £500, to include a brick-lined furrow to carry water for irrigation purposes. The dam, as now completed, has an up-stream vertical face, and the down-stream face is to a batter of 2 in 3. The length of the crest is 112 feet and the width 2 feet. At each end of the crest the masonry is steeply sloped up to the rock face in order to prevent erosion at the sides when overflowing. The height of the dam is 18 feet in the centre and a 4 inch outlet pipe is provided.

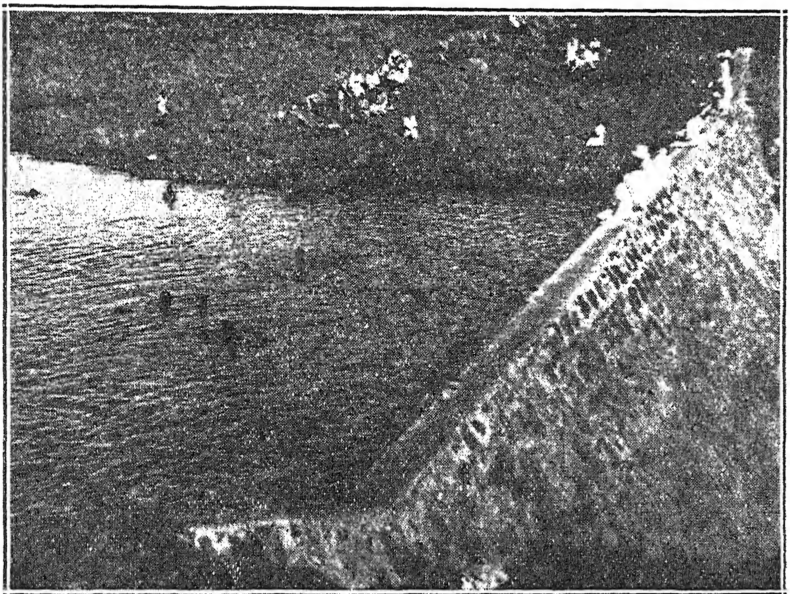
The site of the dam on the day of beginning operations.



Nearing the crest.

Below the dam is a small pick-up weir 5 feet high, from which the irrigation furrow will be laid. It will act as a water cushion to receive the impact of floods from the main dam and also affords additional storage.

Great care was exercised in securing a satisfactory foundation for the structure. It was necessary to excavate to a depth of 5 feet at the bottom of the gulley in order to secure a sound rock bottom, and a good deal of stone had to



The dam partially filled. The girls of the institution enjoying a swim.

be removed from the slopes for a similar purpose. A thick bed of concrete was laid on the rock bottom and forms the foundation upon which the dam was built. For this purpose the ironstone blocks strewn in abundance on the hill-side were made use of, each block being carefully cleaned previous to being laid. Owing to the irregular fracturing of the ironstone, more cement mortar was used than was at first anticipated. This was, however, compensated for by economies in other directions which enabled the work to be completed within the estimated sum. The strength of the mortar used was 1 in 3 and the wall was pointed with

fine cement as the work proceeded. The finished work is quite water-tight, and little or no seepage appears to be taking place.

To obtain an even batter a tight line was stretched across the dam in the position ultimately occupied by the outside edge of the crest. From this line two lines, one at each end, were carried at the required batter to the foundation. Between these lines horizontal lines were run to which the native masons built. They were by this simple means able to give the batter an even and well-finished appearance. The dam took five months to complete with four native masons and twelve labourers working on it. The only difficulty encountered was the maintenance of an adequate supply of sand owing to there being none locally. The flooding of the foundations in the early stages of the work also occasioned a little inconvenience, but, as soon as the work had advanced above foundation level, a constant supply of water for building purposes became available, and a considerable saving was in this way effected.

As there is no permanent stream through the gap, the soil is naturally very dry and a great deal of the water collected in the dam since its completion has been absorbed. This will necessarily continue to take place until the ground becomes water-logged, when it can reasonably be expected to hold well. It will, however, probably be a few years before this takes place, but, with the experience gained since the completion of the work, we can reasonably hope to have a sufficient supply of water to carry us through the dry season, even allowing for the heavy evaporation.

I should like, in conclusion, to record my appreciation of the services rendered by the Irrigation Department, but for whose help I should have hesitated in embarking on a piece of work of a kind I had not hitherto attempted.

CONTOUR RIDGES.

By R. H. Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.

A correspondent, who is a keen exponent of contour ridging and who has constructed a record mileage of ridges on his farm, asks in a recent letter for confirmation of the manner in which he has built his ridges, and it seems opportune—now that we are at the commencement of another season of the work of checking soil erosion—to discuss the points which he raises.

The first one concerns the size of the ridges and whether it could safely be reduced. When contour ridges were first built in Southern Rhodesia the scheme was naturally somewhat in the nature of an experiment, and for safety's sake the Irrigation Office recommended that they should be made three feet high and twelve or fifteen feet wide at the base. The reason for this was obvious. It was known that very heavy local rains could be expected to occur, but, in the absence of accurate knowledge of the intensity and amount of run-off, it was felt that a good margin should be allowed. Subsequent experience has led the Irrigation Division to realise that these dimensions were unnecessarily large, and that under normal conditions it is sufficient to make the ridges eight feet wide at the base and two feet high.

It is important to realise that these dimensions refer to ridges which are reasonably well consolidated in the building, and that if soil is merely shovelled into place a considerable amount of settlement is going to occur. This settlement depends on the nature of the soil and its condition (whether lumpy or well broken down) when building the ridges. A ridge built of unbroken clods will subside as much as six inches when the weather has settled the earth into a solid mass. This question of the height of the ridge is

particularly important at points where the ridge crosses an existing wash-out or small gully, and in nearly every case of broken ridges it has been found that the trouble has originated at such a place. Quite often no attempt has been made to add sufficient material to raise the bank at these low points, and it seems necessary to draw attention very strongly again to the fact that it is not sufficient only to make a ridge three feet high when crossing a wash-out one foot deep. The extra height means extra subsidence when the bank settles down, and the top of the ridge should be several inches *higher* and certainly not lower than the crest of the ridge on either side. The silt layer will always show up that sort of defect, since it lies at an even level. Cases have been inspected where the silt level was only a few inches below the top of the bank in the hollow, compared with a good foot and a half to spare a few yards away. The base width is just as important as the height, and should be increased in proportion, so that where the ridge is four feet high the width at the bottom would be fourteen feet.

This naturally means a lot more material, and it is apt to be skimped because it is more difficult to obtain earth at these places; but economy in this respect is very dangerous. Even a small wash-out will bring down a surprising quantity of silt in a single season, quite enough to level up the greater part of the hollow itself and make good the earth (largely sub-soil) taken out to build the ridge. The danger is that the silt tends to collect in a sort of dam which blocks the flow along the ridge, and if the top of the bank is not sufficiently high failure is almost certain to follow.

A very common defect frequently seen in contour ridges is that of building them to a sharp, pointed shape, quite different from the flat-topped section illustrated and described in all the recommendations of the Irrigation Division. The top width of a contour ridge is as important as the height. If a ridge is built to the correct height and sufficient width on top (two or three feet), there is very little else to worry about. The final shape of the ridge will then look after itself, since each type of soil has its own "angle of repose."

Another point raised by our correspondent related to the manner in which earth was to be obtained (using hand

labour almost entirely). In his case soil had been taken from both sides of the ridge in the form of narrow and somewhat deep trenches, in order to economise both in the width of land occupied by the ridges and in good surface soil.

The objection to this procedure, of course, is that the existence of this definite deep channel tends to run off the water too quickly to allow silt to be freely deposited; but the following alternative may appeal to those farmers whose conditions permit of digging out sub-soil to a considerable depth and who wish to give up as little good land as possible. Briefly, it would consist of digging out long, narrow trenches, possibly one foot six inches deep, but *not* continuous—in other words, to dig a series of long, narrow pits, separated from each other by blocks of earth four or five feet long. These blocks would prevent the water running in a narrow, deep channel, and each pit would act as a silt trap, the filling up of which could be hastened by ploughing in a suitable manner to turn the soil back.

This method, however, is not likely to have a general appeal, since the sub-soil on most farms does not lend itself to cheap excavation. The loss of a few yards of top soil is only temporary, and if (as is known to be practised in at least one case) the denuded strip is planted to a green manure crop for the first season, the soil, with the addition of the silt deposits, will quickly come back to normal.

The great thing to aim at is to induce the water to flow in a broad, shallow stream as soon as possible after completing the ridges, and any definite deep channel will increase the velocity to a point where little if any silt will be deposited.

Most of the remarks above apply to ridges built by hand, but are just as important for ridges on which a ditching implement has been used. A certain amount of work is always required to "finish" the ridges started by a ditcher, and the work should be carefully supervised to make sure that the ridges are of ample height and width to allow for settlement, particularly where they cross depressions or wash-outs.

The maintenance of ridges to make good any damage they may have suffered from cattle, implements or the propensities of natives digging out rats is a matter usually

honoured more in the breach than the observance, but its importance cannot be too highly stressed. At the same time, a great deal of unnecessary patching will be saved if the ridges are properly built in the first place. The remark sometimes heard that "contour ridges are all right until the rain comes along" is only another way of saying that proper common-sense precautions have not been taken to ensure that the ridges have been soundly made. Contour ridges built according to the simple specifications described above will stand all the vagaries of the Rhodesian rainy season.

To sum up:—

(1) Ridges should be built so that when settlement is complete they will nowhere be less than eighteen inches high, and preferably two feet.

(2) The top width of a ridge is just as important as the height, and should not be less than two feet. The other dimensions will look after themselves if you look after the height and top width.

(3) See that ridges are made extra high and wide when crossing an existing hollow. It will soon fill up with silt.

(4) Pay proper attention to maintenance, and at the beginning of each rainy season make sure that the ridges are in a good state of repair.

(5) A little trouble in building the ridges in the first place will save a lot of patching later on.

BULAWAYO MUNICIPAL DEMONSTRATION STATION.

FINAL REPORT, 1932.

By D. E. McLoughlin, Assistant Agriculturist.

Foreword.—Work on this station was commenced in 1921, when the Municipal Council of Bulawayo acceded to a request from the writer that they would co-operate with the Department of Agriculture in providing an experimental station for Matabeleland.

The Longila Experiment Farm, near Lochard Siding, had been opened in 1912 as an experimental centre for the southern part of the Colony, but curtailed expenditure necessitated by the Great War led to its closing down in 1915. From that date until 1921 the Department was without an experimental station of any kind in Matabeleland, and in consequence was severely handicapped when called upon to advise on questions of arable farming in that portion of the Colony.

A site for the station was selected on the commonage, and the land—a red clay loam—was broken up for the first time in 1920.

Thanks to successive Town Councils and the ratepayers of Bulawayo, the station has completed ten years of very useful work, and operations on it are only discontinued since the Matopo School of Agriculture, with its resident staff of technical officers, can more conveniently conduct such investigations.

The grateful thanks of the Department of Agriculture are accorded to the ratepayers of Bulawayo, to the Town

Councillors concerned and to past and present officials of the Council, without all of whose continued interest the station could not have been maintained.

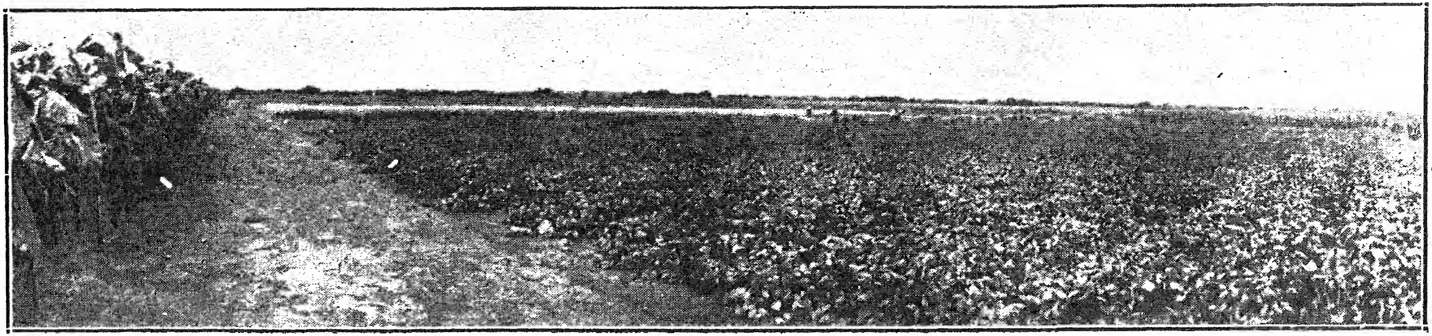
H. G. Mundy,
Chief, Division of Plant Industry.

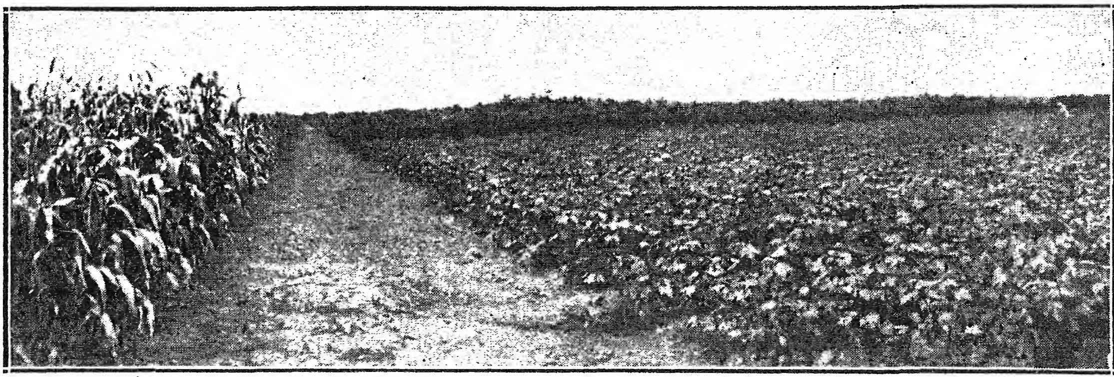
Out of the ten seasons experienced at this station only three recorded a precipitation in excess of an average annual total of 21.95 inches, one verged on the normal and six were considerably below the average. The six droughty seasons averaged only a 14.33-inch rainfall, and demonstrate very well the drought-resistant character of certain crops, which renders them capable of being grown extensively in Matabeleland, notably dolichos and velvet beans, cowpeas, jack bean, and that invaluable fodder crop, Sudan grass.

Seasons entirely favourable for crop production and resulting in maximum yields would have been undesirable, and would have greatly detracted from the value of the information which has been acquired. The conditions encountered over the ten-year period may fairly be taken as no better than those which the Matabeleland farmer may normally expect to experience.

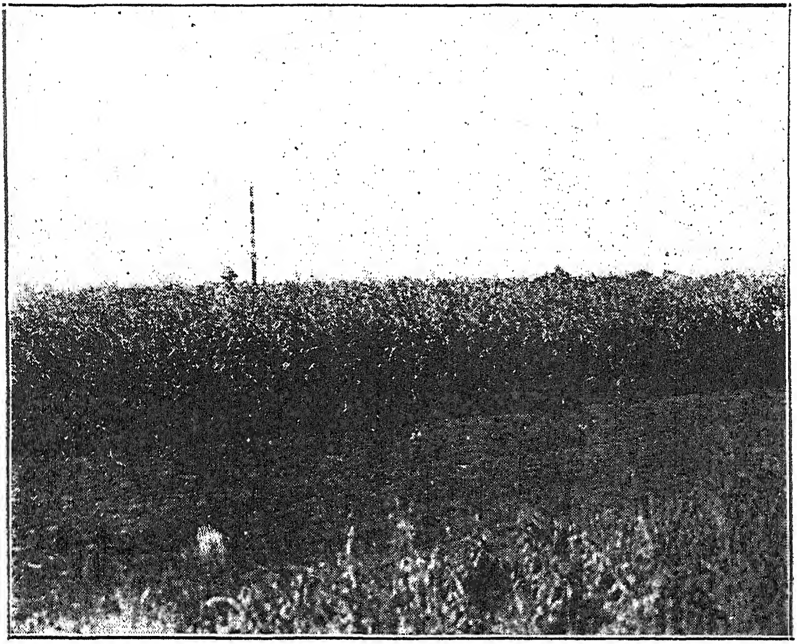
A comparison of the average yields returned by the different systems of cropping provides a useful example of what can be accomplished under local conditions if the more successful methods which have been demonstrated are adopted. Particular attention must, however, be given to autumn and winter ploughing and to preparatory tillage prior to the advent of the rains.

The many unfavourable seasons have provided a severe test of the rotational systems which have been followed, including a legume ploughed under as an alternative to farm manure, for maintaining the supply of organic matter in the soil. The sometimes depressing effect of a normal dressing of farm manure or artificial fertiliser when applied direct to the maize crop and the less damaging effect of the same application of fertiliser following a green manure crop ploughed under have been disclosed by the last four-year cycle of the rotations.

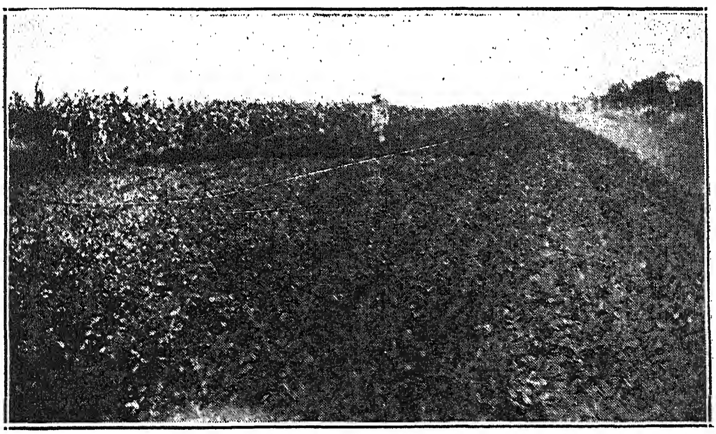




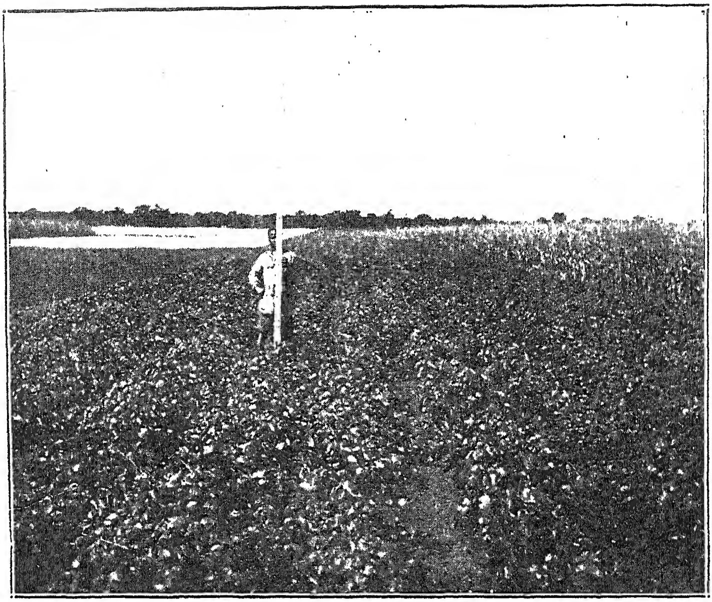
General views of plots at Bulawayo Municipal Demonstration Station.



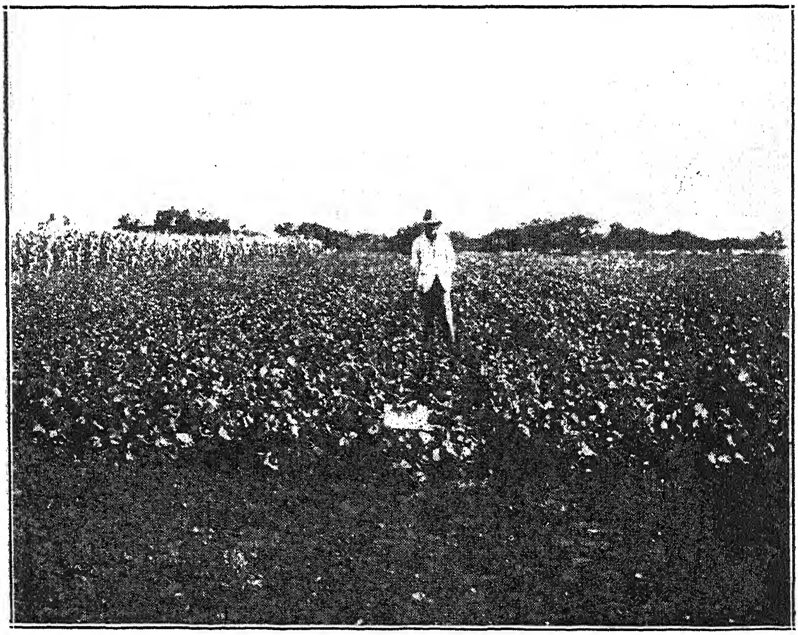
Sudan grass in Rotation Series No. 1. Green yield per acre: first cutting, 8,968 lbs.; second cutting, 3,056 lbs. Rainfall: 17.99 inches. Bulawayo Municipal Demonstration Station.



Ground nut variety trials. Spanish Bunch in foreground; Virginia Bunch in background. Spanish Bunch yielded 18.3 bags and Virginia Bunch 23.1 bags per acre. Rainfall: 17.99 inches. Bulawayo Municipal Demonstration Station.



Velvet beans, without manure or fertiliser. Rainfall: 21.54 inches. Bulawayo Municipal Demonstration Station.



Dolichos beans, variety trials. Yield of seed: 1,007 lbs. per acre. Rainfall: 17.99 inches. Bulawayo Municipal Demonstration Station.

The following tables give the distribution of the rainfall for the season 1930-31 and for the previous nine years:—

TABLE I.

Analysis of Rainfall: Season 1930-31.

Month.	No. of days on which rain fell.	Total for month in inches.	No. of rains exceeding $\frac{1}{4}$ inch.	Total to end of month in inches.
November	7	1.75	1	1.75
December	14	5.41	8	7.16
January	7	3.81	5	10.97
February	4	1.57	3	12.54
March	...	...	...	...
April	...	...	...	...
Totals	32	12.54	17	12.54

Averages for last Ten Years: Seasons 1921-31 (*in inches*).

Year.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Total.
1921-22	nil	0.68	4.37	5.03	0.88	0.69	0.33	nil	nil	12.48
1922-23	nil	1.65	1.97	3.75	6.69	8.76	10.40	nil	nil	33.22
1923-24	nil	nil	3.00	1.20	4.17	4.18	2.70	nil	nil	15.25
1924-25	nil	0.79	5.15	10.11	5.09	6.95	9.91	3.66	3.41	45.07
1925-26	nil	nil	0.53	0.97	3.78	5.49	10.77	nil	nil	21.54
1926-27	nil	nil	1.27	4.33	2.61	4.44	0.44	nil	nil	13.09
1927-28	nil	1.84	1.50	4.22	5.58	0.77	0.64	0.07	nil	14.62
1928-29	0.89	nil	3.09	6.74	8.81	6.47	7.46	0.02	0.18	33.66
1929-30	nil	0.12	3.97	3.86	5.02	0.57	1.97	2.48	nil	17.99
1930-31	nil	nil	1.75	5.41	3.81	1.57	nil	nil	nil	12.54
Average	0.09	0.50	2.70	4.56	4.64	3.98	4.50	0.62	0.36	21.95

Crop Rotations.—The two four-course rotations—series "A" and "B"—demonstrate the effect on the fertility of the soil of two alternative systems of cropping. They were designed to meet the requirements of the man who follows a mixed farming system, combining live stock with the

C

production of cash crops. In one system the humus supply is maintained by the application of farm manure, and in the other by a legume ploughed under. Both rotational systems are well balanced, and the farmer with an insufficient supply of farm manure can safely adopt the alternative method of green manuring.

The land in each case during the four years grows two crops of maize and one of velvet beans, and one of Sudan grass (series "A") and oats (series "B").

In series "A" seven tons of farm manure are applied every fourth year to the one maize crop, while the velvet beans are reaped for green fodder or hay and the stubble ploughed in. Commencing in the season 1926-27, the maize following velvet beans reaped received 200 lbs. of superphosphate (19 per cent.) per acre.

In series "B" no animal manure is used, but the velvet bean crop is ploughed under as a green manure, and the following maize crop receives a dressing of 200 lbs. superphosphate per acre. Here again the maize following after oats has received fertiliser since the season 1926-27. Thus in the one rotation ("A") the land receives seven tons farm manure and 200 lbs. superphosphate per acre during each four-year period, while during a similar period in rotation "B" it receives one green manuring with velvet beans and 400 lbs. of superphosphate per acre.

The maize continuous experiment—series "C" and "D" —provides a check on the above rotations. In the one case (series "C") the maize has been grown year after year on the same land without any application of manure or fertiliser. In the other, series "D," four applications of 160 lbs. per acre of bone and superphosphate have been applied during the last ten years, but no organic matter has been given to the land, either by means of green manuring or farm manure.

TABLE II.

Rotations: Maize Yields in Bags of 200 lbs. each per Acre.

Series "A."

System of cropping.	Average yield for 2nd period.* (Average annual rainfall for period 19.32 ins.)	Average yield for 1st period.* (Average annual rainfall for period 28.77 ins.)	Average yield for 8 years.
Maize, plus 7 tons farm manure per acre (after Sudan grass)	6.81	14.13	10.47
Velvet beans (green fodder) ... ... lbs.	12,699 (3 yrs.)	13,243	13,010 (7 yrs.)
Maize, plus 200 lbs. superphosphate per acre (after velvet beans reaped)	7.68	11.54	9.61
Sudan grass (green weight)—			
1st cutting ... lbs.	9,075	5,657	7,366
2nd cutting ... lbs.	2,173	3,650	2,764
Series "B."			
Maize, plus 200 lbs. superphosphate per acre (after velvet beans ploughed under)	9.00	14.44	11.72
Velvet beans	ploughed under	ploughed under	
Maize, plus 200 lbs. superphosphate per acre (after oats) ...	7.79	10.63	9.21
Oats (grain) ... lbs.	468	1,056	762

* NOTE.—In 1921-22, owing to rawness of land and late planting and drought, all crops on the station were poor and were reaped for silage. In 1927-28 the rains ceased at the end of January, and again, being very poor, crops were reaped for silage. The average yields given above are, therefore, those for the four years in each period in which crops were reaped for grain.

TABLE III.

Maize Continuous.

Maize Yields in Bags of 200 lbs. each per Acre.

System of cropping.	Average yield for 2nd period. (Average annual rainfall 19.32 ins.)	Average yield for 1st period. (Average annual rainfall 28.77 ins.)	Average yield for 8 years.
Maize continuous, without treatment	2.50	6.34	4.42
Maize continuous, plus 160 lbs. bone and superphosphate every alternate year after third year. (Fertiliser applied twice during 1921-25 and twice during 1926-30 periods) ...	6.41	9.70	8.05

The results of the different manurial treatments accorded the maize crop in these cropping systems are of much interest. Reference to Table IV. which follows indicates that in seasons of low rainfall a dressing of 7 tons farm manure per acre applied direct to the maize may depress the yield. In seasons 1923-24, 1926-27, 1929-30 and 1930-31, when the total annual precipitation was less than 18 inches, the maize receiving 200 lbs. of superphosphate per acre (in series "A") exceeded the yield of the maize plus farm manure, and on an average over the four seasons by 2 bags per acre. The greatest difference to the discredit of the farm manure was in the season 1930-31, when the lowest rainfall was recorded. A rainfall of 21.54 inches in 1925-26 favoured the yield of the maize with farm manure to the extent of an increase of 6 bags per acre, but the records that season reveal that the fall of 10.77 inches for the month of March was the highest experienced in any one season out of the ten. Over the three seasons when the precipitation exceeded 33 inches there was an average increase in yield of 3 bags per acre in favour of the maize with farm manure.

In series "B" (second period), the yield of the maize following a green manure and receiving 200 lbs. of superphosphate per acre exceeded that of the maize plus farm manure by 2.19 bags per acre. Over that period the rainfall only once exceeded 18 inches, while the average over the four years was only 19.32 inches.

The beneficial effect of a dressing of 200 lbs. superphosphate per acre applied direct to the maize crop following a legume ploughed under (series "B") is well demonstrated in 1930-31 on a 12.54-inch rainfall. The yield of maize then exceeded that of the maize in the same series receiving a similar dressing of fertiliser and following oats by 2.16 bags per acre in favour of the maize following a green manure.

TABLE IV.

Maize Yields in Rotations during Seasons with less than an 18-inch Rainfall.

Treatment.	Seasonal Rainfall. 1930-31: 12.54 ins.	1929-30: 17.99 ins.	1926-27: 13.09 ins.	1923-24: 15.25 ins.	Total yield, 4 seasons.
Series "A"—					
Maize, plus 7 tons farm manure per acre (after Sudan grass)	2.01	7.15	4.07	10.00	23.23
Maize, plus 200 lbs. superphosphate per acre (after legume reaped) ...	4.29	8.30	6.03	12.25	30.87
Series "B"—					
Maize, plus 200 lbs. superphosphate per acre (after legume ploughed under)	5.66	6.92	7.02	13.50	33.10
Maize, plus 200 lbs. superphosphate per acre (after oats)	3.50	6.90	6.45	8.15	25.10
Series "C" and "D"—					
Maize continuous without fertiliser	1.26	1.42	1.56	6.00	10.24
Maize, plus 160 lbs. bone and superphosphate per acre every alternate year after third year	5.04	6.60*	2.61	6.00	20.25

* Fertiliser applied direct to maize in 1929-30.

The relative effect of the different treatments over the four seasons experiencing a rainfall of under 18 inches is reflected by an increased total yield of 9.87 bags from the maize following a green manure crop ploughed under as compared with the maize receiving 7 tons per acre of farm manure, and of 2.23 bags an acre compared with the yield of the maize plus fertiliser following a legume *reaped;*

while over the same four years the yield of the maize with fertiliser after a legume reaped exceeded that of the maize with farm manure by 7.64 bags.

The yields in series "A" and "B," where organic matter is supplied by means of farm manure or green manuring, exceed that of the continuous maize receiving 160 lbs. bone and superphosphate four years out of eight by over 2 bags per acre, and exceed the yield from the maize continuous plot without fertiliser by nearly 6 bags per acre.

The fact that over a series of exceptionally dry seasons the benefits of green manuring have been fully maintained is contrary to the experiences of many other countries, but in these experiments as well as in those carried out at the Agricultural Experiment Station, Salisbury, the practice has invariably been best rewarded in years of inadequate rainfall.

The results recorded here afford striking proof that green manuring can be recommended for Matabeleland as unreservedly as it can under the more humid conditions of Mashonaland.

Maize Fertilised Direct versus Fertiliser applied to the Preceding Legume Crop.—Here the system of cropping is maize following cowpeas and maize following velvet beans. The object of this experiment was to compare, under local conditions of soil and climate, the effect on the maize crop of applying the normal dressing of phosphatic fertiliser to the maize crop direct as against applying it to the preceding legume crop which is reaped for hay.

The results over a period of three years indicate that when the fertiliser was applied to the preceding legume crop the maize yield was greater in the season 1929-30 by 3.3 bags, and in the season 1930-31 by 2.21 bags per acre. In both seasons the rainfall was considerably below normal. In 1928-29, when the rainfall was 33.66 inches and above normal, the difference was one of 3 bags per acre in favour of the maize receiving fertiliser direct.

When the fertiliser was applied to the preceding maize crop the average yield of legumes was greater by 6,864 lbs. (green weight) over the first two seasons, but in 1930-31 the difference was in favour of the direct application.

The point which seems to emerge here is that on this class of land, which does not retain moisture too well in seasons experiencing a low rainfall, a normal direct dressing of fertiliser may—and, indeed, is likely to—have a distinctly detrimental influence on the maize crop, unless the organic matter supply in the soil has been well maintained. If these conditions have not been complied with, a wise precaution would seem to be to apply half the normal dressing of artificials each year instead of a larger amount every other year.

Linseed.—This crop requires only three months to reach maturity and is, therefore, a useful catch crop in seasons experiencing late rains. It seldom fails to produce a moderate return of seed in Matabeleland. The best yield obtained was in 1924-25, when 532 lbs. per acre were reaped from the white-flowered variety. Linseed is a valuable feed for pedigree stock and young calves, and since the seed is expensive to buy, it can more profitably be produced on the farm. It is a heavy feeder and should be grown on fertile soil.

Linseed Variety Trials.

Variety.	1930-31 (lbs. per acre).	Average (lbs. per acre).
White flowered	240	278 (7 years)
Large seeded	304	231 (4 years)
Yellow seeded	432	432 (1 year)
Small seeded	352	352 (1 year)

Ground Nut Variety Trials.—The results of these trials have been as follows:—

Ground Nut Variety Trials.

Variety.	Yield per Acre (bags of 75 lbs.). 1930-31.	Average Yield per Acre (bags of 75 lbs.).
Spanish Bunch	13.2	16.8 (4 years)
Virginia Bunch	5.7	11.9 (4 years)
Virginia Runner	—	14.1 (1 year)
Japanese Bunch	—	12.8 (1 year)
Jumbo	—	7.2 (1 year)

Virginia Bunch has consistently given a lower yield than Spanish Bunch, except in 1929-30, when conditions permitted of it being planted a good deal earlier than is usually possible. It requires a two to three weeks' longer growing season than

does the Spanish Bunch variety, and for this reason it is not generally so well suited to Matabeleland conditions.

Maize Variety Trials.—The object here has been to determine the varieties which are most suitable to local conditions of soil and climate. No definite rotation has been followed in these trials, but each season the varieties were planted on the same day, received the same manurial treatment and were planted the same distance apart. As far as possible, seed of locally-grown strains was used. Seed of the four standard Rhodesian varieties was supplied each year by recognised growers in Mashonaland. The experiments extend over a period of seven years. Four seasons out of seven recorded a rainfall below normal. In accordance with the general practice, maize was planted in moist ground and at a date when the rains appeared to have well set in. In all, 18 varieties have been tested, including importations from the Union of South Africa and the United States of America, but on account of their low yield or susceptibility to maize blight, many of these were periodically eliminated. The tests were finally reduced to the four standard white dent varieties of Rhodesia and the most promising local acclimatised strains of yellow and white flints.

Despite the fact that seed of the former varieties had each year been grown in an environment (Mashonaland) very different to that of Matabeleland, they out-yielded the early maturing varieties (Matabeleland seed) by 2¼ bags per acre, and this in spite of the early frosts and unusually light rainfall of several of the seasons.

In only one season out of the seven, namely, in 1927-28, when the rains ceased at the end of January, did the early flint varieties show any superiority over the white dents. In no other season, even with a rainfall well below normal, but recording rain throughout February, was there any difference in favour of early flint varieties.

From the returns already quoted it is apparent that even in those seasons experiencing a rainfall of less than 18 inches satisfactory yields can be obtained in Matabeleland from the standard white dents if grown under good farming conditions, while, should the rainfall exceed the normal, then considerably heavier crops will be returned by these than by any

earlier maturing strain yet introduced. The conclusion may be drawn that, except in very dry areas, when conditions permit of planting by the 20th December, no advantage will usually be secured by substituting early flint varieties for white dents. If planting must be delayed until after Christmas, resort to early varieties is advisable.

Quick maturity is not generally associated with high yield, and there is room for the breeding of a variety for Matabeleland which is somewhat quicker to mature than Salisbury White or Potchefstroom Pearl, which will maintain a high yielding character and which at the same time will be resistant to maize blight.

The maintenance of sufficient organic matter in the soil and good preparatory tillage, particularly autumn and early winter ploughing, and thorough cultivation to suppress weeds, are the factors of chief importance in crop production in Matabeleland, for in areas of somewhat uncertain rainfall the essential precautions are (1) to be prepared to plant immediately the combined state of the land and the weather conditions permit, and (2) to absorb and retain for useful purpose as great a proportion of the precipitation as possible. Neither of these provisos can be complied with by the farmer who awaits the first soaking rains of the season before commencing to plough and prepare his lands.

Experience on this station would indicate that, providing the land has been well ploughed, is in good heart and is subsequently cultivated to conserve the moisture, an inch of rain in December will tide the maize crop over a period of three weeks without further rain.

Variety Trials.

Average of Duplicate Plots.

Variety.	Average Yield per Acre (in Bags of 203 lbs.) over 7 years.
Louisiana Hickory	8.80
Potchefstroom Pearl	8.48
Hickory King	8.45
Salisbury White	8.40
Yellow Flint	6.64
American White Flint	6.33 (4 years)
Sahara Yellow	6.9 (2 years)
Golden Beauty	6.8 (2 years)

Other varieties tried and discarded for various reasons—usually extreme susceptibility to maize blight—are Krug, Wisconsin White Dent, Iowa Silver Mine, Eureka, Menna, German Yellow, Yellow Cango, Pride of Saline and Minnesota No. 133.

Legumes for Fodder and Grain.—During the last ten years some thirty varieties of legumes have been tested on this station, and the extreme wet and dry seasons experienced over that period have afforded a good opportunity of thoroughly testing out these crops for cultivation on a large scale. Many have proved very tolerant of drought and can be relied on even in the driest of seasons to provide a good supply of fodder, while, in seasons of ample rainfall, their growth is most luxuriant.

In addition to their value as a feed for stock, their cultivation in a suitable rotation with maize or other grain crops aids in maintaining the fertility of the soil, and they should always, therefore, be included by every farmer desiring to practise a sound system of arable cropping. Dolichos beans, velvet beans, jack beans and cowpeas are all valuable as green manure crops, and though sown for this purpose they may, if drought is experienced, be utilised for feed.

The respective qualities of the different legumes have been discussed in previous reports. In view of the results obtained with the white jack bean during the last two seasons on this station, as well as those given by it at the Salisbury Experiment Station, the crop seems deserving of more attention. This bean makes luxuriant upright growth and is remarkably drought-resistant. Its foliage, which is well supported on stout stems, is of bushy nature, and it keeps green after most of the other legumes have dried off.

In 1929-30 on an 18 inch rainfall it returned the greatest yield of grain of all legumes, and in 1930-31 on 12.5 inches its yield was exceeded only by that of dolichos beans. It would appear from results obtained elsewhere in the Colony that it seeds more heavily in rather dry than in wet seasons.

Yield of Legumes for Fodder.

Crop.	1930-31. Lbs. per Acre (green weight).	Average Yield. Lbs. per Acre (green weight).	Period in Years.
Dolichos beans	12,505 (5 plots)	11,498	7
Velvet beans	—	11,331	6
Cowpeas (common) ...	—	8,265	5
Cowpeas (iron)	—	8,265	5
Soya bean	5,572 (4 plots)	5,572	1

TABLE V.

Yield of Legumes for Grain.

Variety.	Average Yield to Date (lbs. per acre).	Period in Years.
Velvet Beans—		
White Stingless	730	7
Tracey's Early Black	524	2
Osceola	462	2
Somerset	279	1
Variety 30/26	359	1
Florida	525	3
S. taborense	375	1
Dolichos Beans—		
Small Brown Seeded	530	6
White Seeded	84	1
Indian	737	1
Ewanrigg	186	1
Tepary Beans	281	4
Kaffir Bean (common)	506	2
Cowpeas—		
New Era	715	3
Common Iron	672	7
Whip-poor-will	477	6
Upright Iron	150	1
Victor	105	1
Brabham	240	2
Monetta	213	2
Dhal	395	4
Sunn Hemp	517	7
Chick Pea or Gram	328	1
Canadian Wedge Pea	422	2
White Jack Bean	849	2
Soya Beans—		
Oo-too-tan	460	1
Herman	487	1
Biloxi	289	1
Chinese	345	1
Laredo	384	1

Silage Crops.—The absence of green herbage in all districts of the Colony during the dry winter months and up to October or later makes it imperative that the farmer should provide a suitable substitute, and the undermentioned results with silage crops demonstrate the success with which they

can be grown in Matabeleland. A crop which until recently has received little attention for this purpose is the natural veld grass. Experiments have proved that green grass retains most of its nutritive value after being ensiled. This being the case, the quantity of green grass usually available and the easy manner in which it can be handled render it a tremendous asset to the live stock farmer.

No matter, however, what reliance may be placed on veld grass silage, most farmers will also deem it expedient to grow special crops for conversion into this product, and the following records are, therefore, informative:—

TABLE VI.

Yields per acre in lbs. (Green Fodder).

Crop.	How sown.	Yield, 1930-31. (Lbs. per acre green fodder.)	Average yield to date. (Lbs. per acre green fodder.)	Period in years.
Sunflower and Velvet Beans	36 x 9 (same row)	18,724	19,121	8
Sunflower and Velvet Beans	20 x 18 (alternate rows)	—	16,339	4
Sunflower alone	30 x 12	10,540	19,162	8
Maize and Velvet Beans	36 x 9 (same row)	10,168	12,823	8
Maize and Velvet Beans	20 x 18 (alternate rows)	—	13,570	4
Maize alone	30 x 12	9,858	13,838	8
Kaffir Corn and Velvet Beans	36 x 9 (same row)	—	8,721	3
Kaffir Corn and Velvet Beans	20 x 9 (alternate rows)	—	14,216	3
Kaffir Corn alone	24 x 9	15,088	12,585	7
Maize and Cowpeas ...	36 x 9 (same row)	—	12,772	1
Maize and Dolichos Beans	36 x 12 (same row)	20,894	20,894	1
Sunflower and Dolichos Beans	36 x 12 (same row)	11,780	11,780	1
Sudan Grass	Broadcast (in Rotation "A")	10,130	10,130	8

Sunflowers either alone or combined with one of the legumes are a dependable silage crop for Matabeleland, and though the silage is less palatable than that made from maize, the yield per acre is greater. On farms where kaffir corn is known to thrive, this will combine well with velvet beans or dolichos beans, while the merits of sudan grass as an easily handled silage or hay crop deserve much more attention than they receive.

Sweet Potato.—The most reliable succulent winter feed for Matabeleland is undoubtedly the sweet potato, but again little attention is yet paid to this valuable crop. It has proved a success in both wet and dry seasons. A heavy rainfall and long growing season are favourable to a heavy yield of tubers and top growth, but in no part of Rhodesia below 5,000 feet altitude is the season too short or the rainfall too scanty to permit of sweet potatoes being grown.

Where the season often is short, it has been found more profitable to refrain from lifting the tubers the first year, or, in other words, to establish the crop with the idea of not lifting the tubers until eighteen or twenty months later. One of the most practical methods of carrying out this system is to establish the cuttings between the rows of a maize crop after the final cultivation, in late January. On the other hand, on well manured land specially set aside for the crop, it can be planted 36 x 18 inches apart, and if established not later than the middle of December should produce a reasonable amount of tops and tubers by the following May or June. The advantages of the sweet potato are:—(1) The tubers can be left in the ground and lifted when required; (2) the tops can be fed green or grazed in late autumn and early spring when green grass is scanty or entirely lacking; (3) by feeding the tubers to dairy cattle, fattening bullocks or pigs, the grain ration required can be appreciably reduced.

The Early Butter variety, by reason of its shorter growing period, has proved the heavier yielder of tubers, and since its combined weight of both tubers and tops is about equal to that of the Calabash Leaf variety, it would appear to be the more suitable variety to grow as a stock feed in Matabeleland.

Sweet Potatoes.

Cuttings planted one Season, and Crop lifted at End of following Season.

Variety.	Average Yield over 6 Years (in lbs. per acre). Tubers (5 years only).	Green tops.
Calabash Leaf	9,356	16,765
Early Butter	13,514	12,434

Grown from Cuttings (planted and lifted the same Season).

Variety.	Average Yield per Acre (4 years).
Calabash Leaf	7,996
Early Butter	5,832

Oats.—Several varieties of oats suitable for sowing in the rainy season have been tried on the station during the ten years, but the crop is intolerant of droughty conditions, and is, therefore, much more uncertain than others referred to more fully in this report.

In spite of not infrequent seasons of low rainfall, Matabeleland as a whole—given reasonably good farming—can grow as wide a range of grains and fodders as will be needed by the average farmer who makes the marketing of his produce on the hoof his primary concern.

MIXING OF FERTILISERS.

A GUIDE TO METHODS OF CALCULATION.

By the Division of Chemistry.

At the outset we wish to make it perfectly clear that in this short article we have no intention whatsoever of advising farmers to make a habit of mixing their own fertilisers from the primary ingredients. Theoretically, this may save a few shillings, but there are two considerations which must be taken into account. On the one hand, no farmer possesses the efficient machinery of the fertiliser firms, so can never hope to emulate the perfection of their mixtures. On the other hand, with unskilled native labour, constant white supervision is necessary, so that on both grounds the practice may well turn out to be a waste instead of an economy. These firms charge only a small percentage for mixing, and their final products are uniformly up to standard. This is evidenced by the closeness with which their mixtures invariably approach the guaranteed composition on being analysed by the Government analysts, so that in the end a farmer is well repaid for the small extra charges. He is always sure of getting good value, and need never be afraid that the mixture he buys is below what is stated in the catalogues, for he is fully protected by the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance, 1914."

There are, however, occasions when it may pay a farmer to mix for himself. Owing to the recent depressed conditions, and the fact that several farmers have gone—temporarily, we hope—out of business, stocks of unused fertilisers from previous years have frequently been for sale of late at greatly reduced prices, and it certainly would be profitable for neighbouring farmers to purchase these and mix with others to suit their own requirements.

During this past year, we have had numerous requests from farmers telling us that they had acquired a stock of this fertiliser, or that, or several, at reduced prices, and asking us to advise them how to mix them, or in what proportion to mix them with others, which they were prepared to buy from the fertiliser firms, in order to make a particular mixture to suit some special crop or soil.

We have also had enquiries from some who felt from experience that none of the stock mixtures from the local firms was quite suited to the crop they wished to grow, or, it might be, to the soils on their farms. Some, indeed, wish to experiment with entirely new mixtures, and, realising that extra charges must necessarily be made for the preparation of a small lot of a special mixture, decide to purchase the basic elements and mix themselves.

All these are justifiable and worthy of encouragement, and it is to assist in the very simple calculations necessary to determine the proportions of the ingredients that these short notes are written.

It is necessary, however, particularly to those without chemical knowledge, to give a word of warning that there are grave dangers of losing valuable fertilising ingredients or of rendering the finished fertiliser physically unfit for application if certain mixtures are made. The former defect is liable to occur through harmful chemical action taking place whereby valuable plant food is lost, the latter usually through moisture being absorbed from the air, causing the final mixture to consolidate into hard blocks, or to become sticky and impossible of uniform application. There is also a danger in mixing heavy large-grained simple fertilisers with exceedingly fine-grained ones that the latter will separate out leaving the other on top, with the result that no homogeneous mixture of these can ever be effected by home-made methods.

This being so, it is only a matter of common precaution to know definitely which of the common fertilisers may safely be mixed and which may not. In any event, even with fertilisers which may safely be mixed without chemical action taking place, it is safer always to mix just before using. For example, although there is no objection from a chemical point of view to mixing muriate of potash with

superphosphate, if the final product is left for more than a few hours, it will become quite wet, sticky and almost impossible to distribute.

The three following simple rules form a safe guide with the fertilisers commonly in use in this Colony. It may be observed, however, that even these may be disregarded if the mixture is completed just *immediately* before applying, when little loss will be incurred.

1. Never mix lime or any fertiliser containing free lime (such as basic slag) with any fertiliser containing its nitrogen in ammoniacal form (such as sulphate of ammonia).

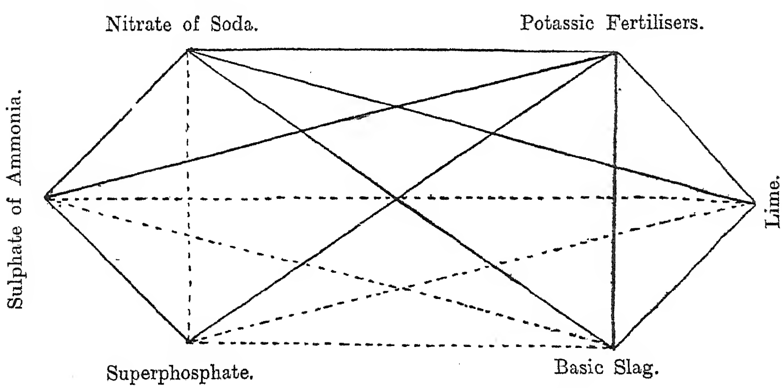
Chemical action causes the ammonia to be set free, with the consequent loss of valuable nitrogen.

2. Never mix lime or any fertiliser containing free lime with any phosphatic fertiliser containing all or a part of its phosphates in water-soluble form (such as superphosphate).

Chemical action causes the water-soluble phosphate to revert to a more insoluble form, with a consequent inferior distribution among the soil particles.

3. Never mix nitrate of soda with superphosphate, for chemical action sets in causing evolution of nitric acid, with a consequent loss of nitrogen.

The following little diagram, copied from "Elementary Agricultural Science," by William Smith, M.A., B.Sc. (Agric.), gives a clear picture of which are safe and which are unsafe mixtures.



——————— Those which may be mixed.

– – – – – – Those which may *not* be mixed.

We shall now give examples of the methods of calculation employed in preparing required mixtures from certain known and available ingredients.

1. Suppose a farmer has a stock of 20 per cent. superphosphate and he wishes to mix this with sulphate of ammonia (20 per cent. nitrogen) and muriate of potash (60 per cent. potash) to obtain a complete fertiliser, say of composition 15 per cent. phosphoric oxide, 3 per cent. nitrogen and 5 per cent. potash.

	P_2O_5	N	K_2O
In 100 lbs. mixture we require	15	3	5
To get 15 lbs. P_2O_5 we must use $\frac{15 \times 100}{20}$ = 75 lbs. superphosphate	15	—	—
To get 3 lbs. N we must use $\frac{3 \times 100}{20}$ = 15 lbs. sulphate of ammonia	—	3	—
To get 5 lbs. K_2O we must use $\frac{5 \times 100}{60}$ = 8.3 lbs. muriate of potash	—	—	5
	15	3	5

Therefore to make a ton we must mix—

20 x 75 = 1,500 lbs. superphosphate.
20 x 15 = 300 lbs. sulphate of ammonia.
20 x 8.3 = 167 lbs. muriate of potash.
33 lbs. filler.

2,000

A suitable filler is fine sand, of which supplies are usually readily obtainable. Raw rock phosphate might be used in some cases where an increase in the phosphoric oxide content would be of value and would not materially upset the balance of the mixture. This compound would be equally as effective

as sand in obtaining a dry composite mixture. In a mixture such as the above the quantity of filler is so small that it might be omitted without the composition of the resulting product being appreciably altered.

2. Requests have been received from farmers who have purchased supplies of concentrated complete mixtures and who desired to add single ingredients to these in order to bring the resulting product to the composition of some well-known fertiliser. Suppose it is desired to reduce a fertiliser "A" containing 25 per cent. phosphoric oxide, 12 per cent. nitrogen and 15 per cent. potash to one approximating a complete fertiliser of the composition 20 per cent. phosphoric oxide, 4 per cent. nitrogen and 6 per cent. potash.

	P_2O_5	N	K_2O
In 100 lbs. mixture we require	20	4	6
To get 4 lbs. N we must use $\frac{4 \times 100}{12} = 33\frac{1}{3}$ lbs. compound "A"	—	4	—
This being one-third of 100 also gives $\frac{1}{3} \times 25 = 8.3$ lbs. P_2O_5	8.3	—	—
and $\frac{1}{3} \times 15 = 5$ lbs. K_2O	—	—	5
Now use 17.5 per cent. superphosphate for remaining 11.7 lbs. P_2O_5 $\frac{11.7 \times 100}{17.5} = 66\frac{2}{3}$ lbs. approximately	11.7	—	—
	20	4	5

To make a ton we must mix—

$20 \times 33\frac{1}{3} =$ 667 lbs. compound "A."

$20 \times 66\frac{2}{3} =$ 1,333 lbs. 17.5 per cent. superphosphate.

2,000

That is one part given compound and two parts superphosphate.

Raw rock phosphate is often used in reducing such compounds. In this way the high phosphoric oxide content is maintained, although the water-soluble portion is much diminished. One part of the above compound and two parts raw rock phosphate would give a mixture of composition 30 per cent. phosphoric oxide, 4 per cent. nitrogen and 5 per cent. potash. In this only 8.3 per cent. phosphoric oxide would be water-soluble.

3. A final example is given showing how a complete mixture with the various components in a definite desired proportion may be obtained. Suppose the well-known tobacco fertiliser of composition 20 per cent. phosphoric oxide, 7 per cent. nitrogen and 10 per cent. potash is required. Further, suppose that 4 per cent. of the nitrogen must be in the form of ammonia and 3 per cent. as nitrate, and that 6 per cent. of the potash be sulphate and 4 per cent. muriate. The ingredients necessary will be:—

(1) A concentrated compound containing phosphoric oxide and nitrogen. There are several such compounds on the market containing the nitrogen in the form of ammonia. Suppose we have one with 50 per cent. phosphoric oxide and 10 per cent. nitrogen: Compound "B."

(2) Sulphate of ammonia to complete, if necessary, nitrogen content as ammonia (20 per cent. nitrogen).

(3) Nitrate of soda to give nitrogen as nitrate (16 per cent. nitrogen).

(4) Sulphate of potash to give potash as sulphate (48 per cent. potash).

(5) Muriate of potash to give potash as muriate (60 per cent. potash).

	P_2O_5	N	K_2O
In 100 lbs. mixture we require	20	7	10
To get 20 lbs. P_2O_5 we must use $\frac{20 \times 100}{50}$ = 40 lbs. Compound "B" ...	20	—	—
This also gives $\frac{40 \times 10}{100}$ = 4 lbs. nitrogen as ammonia ...	—	4	—
This supplies all the ammoniacal nitrogen, so no sulphate of ammonia is required.			
To get 3 lbs. N as nitrate we must use $\frac{3 \times 100}{16}$ = 17.75 lbs. nitrate of soda	—	3	—
To get 6 lbs. K_2O as sulphate we must use $\frac{6 \times 100}{48}$ = 12.5 lbs. sulphate of potash	—	—	6
To get 4 lbs. K_2O as muriate we must use $\frac{4 \times 100}{60}$ = 6.7 lbs. muriate of potash	—	—	4
	20	7	10

Therefore to make a ton we require—

20 x 40	=	800 lbs. Compound "B."
20 x 17.75	=	355 lbs. nitrate of soda.
20 x 12.5	=	250 lbs. sulphate of potash.
20 x 6.7	=	133 lbs. muriate of potash.
		462 lbs. filler.
		2,000

It is hoped that these examples will be of value in enabling farmers who contemplate preparing their own mixtures to make their preliminary calculations, but, if difficulties are still encountered, the advice of the Division is always available, and will be gladly given.

ALEURITES FORDII (THE TUNG OIL TREE).

The following extracts are taken from Bulletin 221 of the University of Florida Experiment Station:—

Drainage.—Without sufficient drainage the trees will not continue to show a thrifty and satisfactory growth, irrespective of other cultural attentions given them. Surface drainage only is not sufficient; the water table must be considerably below the soil surface level.

Propagation.—The common practice is to plant seeds in a nursery bed in early spring, the seedlings being transplanted to permanent field positions after one season's growth. The nursery method seems to be preferable to planting seeds directly in the field where the trees are wanted in that the cost of required cultivation for the same number of trees is almost negligible in the nursery as compared with field plantings.

The seeds do not remain viable over an extended period and, if to be used for planting purposes, must be planted during the season following their maturity. In the nursery row they are planted at a depth of 2 to 4 inches, spaced 8 to 12 inches apart in the row, with the rows not closer than 3 feet. Approximately 60 days are required for germination. Hulled seeds only should be planted, as the planting of whole fruits results in a cluster of more or less spindling and malformed seeds which, because of their crowded condition, do not develop into straight, vigorous stock.

Frequent and shallow cultivation should be given from the time the seedlings appear until midsummer.

Complete commercial fertilisers, barnyard manures, and varying forms of nitrogenous fertilisers have all been used to advantage in the growing of the young trees. One or two applications are made, the first after the seedlings are a few inches high and the second in early summer.

Transplanting and Cultivation.—In general the same methods are used in transplanting tung-oil trees from the nursery to the grove as with other fruit or nut trees.

In this connection, the question of the distance to plant naturally presents itself. As there are no mature groves of tung-oil trees in the United States, the answer to this question is yet largely problematical. On the strength of the size attained by the trees in China some have recommended that they be planted as close as 20 feet each way. However, it seems that this is too close for Florida conditions, where, with good care, the trees apparently exceed in size those in China. It should be remembered that the latter are practically uncultivated, receive little or no fertiliser, and are said to grow upon the poorest of soils.

It would seem best, in the light of present information, to set the trees 25 x 25, 25 x 30, or even 30 x 30 feet apart. However, in order to economise in the matter of cultivation and care it appears entirely practical to plant trees, say, 25 or 30 feet one way, and half this distance the other, with a view to transplanting alternate trees to other groves when they become crowded. There is every reason to believe that trees several years of age can be transplanted successfully, if as great care be observed, for example, as in transplanting large citrus trees.

In setting the trees it is of utmost importance that they are not planted too deeply. The proper depth is that at which they stood in the nursery row, and if planted much deeper it may be the cause of failure in these trees.

All malformed nursery stock or trees which have become stunted from any cause will ordinarily fail to grow into vigorous field trees irrespective of later attention given. A rigorous grading and discarding of all nursery stock below a high standard is of utmost importance as an initial step towards a thrifty permanent planting.

Pruning.—Pruning of older trees, other than the removal of dead, broken, or interfering branches, seems to be of no advantage and unnecessary. Due to the manner of fruiting, the fruit being borne only on twig terminals of the previous season's growth, any pruning evidently tends to reduce the number of fruiting twigs, with a consequent reduction of yields.

FARMING CALENDAR.

April.

BEE-KEEPING

The notes given for last month will in the main apply to April also, according as to how the season develops. New swarms are not recommended to be hived during this month unless they are supplied in the first instance with fully drawn out frames and the owner is prepared to feed them now and again during the winter. As April should be a very active month for the bees, watch carefully the progress of the crates in which surplus honey is being stored, and have plenty of frames—fully drawn out if possible—ready fixed with foundation so as to place on extra crates as occasion may require; these should be placed under the full or filling one and not on the top, as might appear the case. For the benefit of those who would like a little honeycomb, it might be stated that if two or three shallow frames are fitted with four empty comb sections, and placed in the crate, the bees will take to this plan and so provide both comb and honey for extraction in the one crate. In this African climate full crates can be left on the hive with safety until ready for extraction, but if any are taken off they must be watched now and again until they are extracted for damages from the wax moth, which in a day or so can ruin both the comb and honey.

CITRUS FRUITS.

During the first half of this month, autumn budding can still be performed if the sap is still up and the bark of the stock slips freely. Unprofitable and off type trees that have been headed back for top working and which have been carefully thinned out may have the shoots on which February-March buds have failed re-budded to profitable varieties. If the March rains have been sufficient and ploughing and cultivation have been completed, continue cultivation to retain soil moisture and destroy winter weeds. If a dry March has been experienced and cultivation has been badly performed, irrigation should be commenced or continued to keep the trees and fruit in good order. If not already applied to the unthrifty trees which are late with their autumn flush, soluble fertilisers containing nitrogen and phosphoric oxide can be applied with advantage to these trees. The fertiliser should be worked into the soil with a cultivator and followed up with an irrigation. Exporters should have everything in readiness for packing the early fruit, which should be fit to market about the end of the month. Scale infested fruit will be unfit for export unless treated at once. See entomological notes for treatment.

CROPS.

If sufficiently mature, begin cutting and stooking early maize over a small acreage and plough up the ground whilst still damp between the rows of stooks. If ripe, reap and husk early planted maize, and keep in a separate dump. Continue to make field selections of the best maize plants, and mark those required for seed with strips of coloured cloth. Lift any ground nuts and potatoes showing signs of making second growth. Make silage; cut maize for this when the ears are in the "dough" stage.

Pick up and stook maize plants blown over to protect the ears from white ants. Feed sweet potato vines to stock, reserving any new growth of vines for feeding as grazing in May. Plough in any green manure crops not already turned under. Plough fallowed land. Keep potatoes reserved for seed on racks in a cool place protected from frost, but well ventilated. Transplant onions from seed-beds to irrigated or naturally moist lands; irrigate about once a week, but do not apply too much water. Pick over potatoes which may be lifted, and remove the bad and diseased ones. Winter cereal crops for grain can be sown towards the end of the month. Cart manure to the lands. Remember that good and deep ploughing to a depth of at least 7 to 8 inches is essential, and the basis of all successful arable farming. If the lands are not already ploughed so deep, increase the depth of ploughing about an inch a year until this depth, or even more, is reached. On lands which have been ploughed for a number of years at the same depth, use a grubber to stir up the sub-soil without lifting it to the surface. Too much attention cannot be paid to good tillage. It is usually good practice to follow the plough at once with a harrow or other suitable implement to break down the clods before they bake hard. Continue breaking up new lands; the earlier this is done the more complete is the decomposition of the vegetable matter in the soil. When making hay of coarse legumes such as velvet and dolichos beans and cowpeas, be sure that the vines are dry before stacking. Handle the hay as little as possible to avoid loss of leaf. Thought should be given to laying in supplies of thatching grass for thatching and repairing roofs. The veld may be beginning to dry off. Consideration may be given to mowing or otherwise preparing fire lines as a preventive against veld fires.

DAIRYING.

At this season of the year the milking kraal is generally far from clean owing to the excessive amount of mud or dust which has accumulated during the latter part of the rainy season, and in consequence farmers invariably have trouble in producng first-grade cream. Every endeavour should be made to erect a small milking shed in which four or five cows or more can be milked at a time, and every effort should be made to keep the cows clean. The udders should be wiped before milking with a clean, damp cloth, and the farmer should see that the natives' hands are washed with soap and clean water before and after each milking.

If butter is made, the cream and washing water should be put out overnight, and if the cream is churned early the following morning, very little difficulty should be experienced in obtaining a good grain and a firm body in the butter.

From this time of the year onwards, cheese making operations are usually most successful. The evening's milk should not be kept in the dairy, but should be placed outside, preferably in a bath, and covered over with butter muslin, cheese cloth or mosquito gauze netting. Care should always be exercised, however, in using evening's milk. Morning's milk plus a starter usually gives the best quality, and if a starter is used, care should be taken that it shows no signs of gasiness or off flavours.

The season of abundant green pasture is over, and the natural grazing, unless supplemented by some green food or succulent roughage, is not sufficient to maintain a full flow of milk. The most economical supplement to veld grazing at this time is maize silage, and this should be fed in liberal quantities to all milking cows and growing stock. A few pounds of concentrates in addition would also be of great benefit to the milking cows, which should not be compelled to subsist entirely on veld hay and silage.

DECIDUOUS FRUITS.

If not already done, orchards should be ploughed, harrowed and well cultivated to retain the soil moisture for spring blossoming and growth.

Varieties such as the Chinese peaches, etc., may be pruned after the leaves have dropped.

Order all trees for winter planting during June-July. August planting is unsafe for many early growing varieties of fruits.

All late apples should be harvested and stored or marketed.

ENTOMOLOGICAL.

Maize.—Although certain pests, such as earworm and stalk borer, may be in evidence, there are practically no operations against insect pests that can be carried out economically during this month.

Tobacco.—Any remaining plants showing stem borer attack should be removed and burnt. Watch should be kept for the emergence of the adult wireworm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20-30 gallons of water. The bait should be rolled into a small ball and scattered on the lands, one ball to each 10 square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 8 lbs. per 10 gallons. The bait is best laid in the evening.

Cotton.—Damage to bolls from bollworms may be noticed by the flaring of the bracts and the dropping of the bolls. All dropped bolls should be collected and destroyed. Guinea-fowl, turkeys, etc., may be encouraged to destroy stainers, etc. Stainers should be trapped in traps of cotton seed or trash and destroyed.

Citrus.—Collect and destroy infested fruit to keep down citrus codling moth. Red scale should be destroyed by fumigation with hydrocyanic acid gas or with resin wash. Soft brown scale may be controlled with resin wash. It will be controlled by fumigation with hydrocyanic acid gas where this is practised against other scale insects. Aphis may develop on young growth and may be kept down by spraying with nicotine or home-made tobacco wash.

Vegetable Garden.—Plants of the cabbage variety are liable to suffer severely from cabbage louse and Bagrada bug. The former can be kept largely suppressed by frequent washings with a strong spray of cold water or with a nicotine spray. Bagrada bug is more difficult to control. Crude carbolic emulsion, 1 part in 15 parts of water, or resin wash gives partial control. The spray must hit the insect to kill. Do not re-plant a cruciferous crop (cabbage family) on the same plot. Thoroughly clean and work the soil.

Potatoes.—Potatoes should be cultivated systematically and hilled up to keep the tuber moth from the tubers.

FLOWER GARDEN.

The garden can generally be depended upon to make a good show in the autumn and early winter, provided that the plants have been previously kept in a healthy condition by watering, mulching and feeding. Snap dragons and other seedlings, also cuttings, may now be planted out into their permanent positions. Sowing may be made of hardy annuals, such as hollyhocks, larkspur, clarkia, pansy, petunia, sweet peas, gaillardia and candytuft. Bulbs of spring flowering plants may be taken up, divided and replanted.

VEGETABLE GARDEN.

Sow at once all that is required to fill up the vegetable garden before the soil has parted with all moisture. Seeds sown now will germinate freely, and plants will establish themselves more quickly than during the colder weather, which can soon be expected. A start should now be made at cleaning asparagus beds. This is a most popular vegetable, and yet one rarely sees it cultivated in the ordinary Rhodesian garden.

It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily managed vegetables in the whole garden. Depth of good soil and plenty of manure are all that this plant requires. Rhubarb roots may be taken up, divided and replanted this month. Plant out from seed beds cabbage and onion plants into their permanent quarters. Sow a full crop of peas, broad beans, turnips, onions, lettuce and radish.

FORESTRY.

Cultivate the soil in the young plantations either by means of machines or hand labour. The cultivation will conserve moisture. Hoed out weed growth should be applied as a mulch round the base of each young tree. Be careful not to pile earth round the stems of the young trees. Covering the stems with earth even for an inch or two interferes with sap circulation and invites attacks by termites.

Prune the young trees to single stems. Any exceptionally strong undesirable branch growth may be checked by breaking off the leading shoot, but ordinary branch growth should not be touched.

POULTRY.

The first chicks should now be out, and these, having been hatched, must be well looked after. No food should be given for the first 36 to 48 hours. Leave them to sleep as much as possible. See that they have plenty of fresh warm air, but are not exposed to draughts. After 48 hours give some small grit and charcoal to purify the intestinal tract and aid digestion. A pamphlet dealing very fully with incubation and rearing of chickens can be obtained gratis on application to the Poultry Experts, Department of Agriculture.

One comes across many cases of wrong treatment of chickens in this country, the chief being uncleanliness, over-crowding, giving food too early and dirty drinking water. Two most important foods are animal protein, especially in the form of thick separated or whole milk and green food, especially onions or eschalots or their green tops. The loss in the rearing of chicks is very great; this should not be so if good breeding stock is used, the eggs from these are carefully handled and incubated and the chicks reared with care and common sense.

Any turkey chicks hatched at this time of the year should be well looked after. They should be kept warm, dry, free from insects, fed on dry food only, given plenty of thick separated milk, onions or onion tops, dry mash and grain. A pamphlet on turkeys and turkey rearing is obtainable gratis from the Poultry Experts.

Ducks should do well during the month, the weather being as a rule cool, moist and bracing; but the houses in which they sleep must not be damp. Duck breeders should always be on the "qui vive" for a round worm called "Trichosoma contortum," which is often fatal to ducks. It is found in the œsophagus, and causes arrest of growth, emaciation and weakness and sometimes epileptiform attacks. A swelling will be noticed at the lower part of the neck, which rapidly increases in size, and death occurs in one to three days. Onions, or preferably garlic, mixed with the food is a good preventive and cure. Another good remedy is essence of turpentine mixed with twice its quantity of olive oil and one or two tablespoonfuls given for a dose.

STOCK.

Cattle.—Where winter conditions are good, early spring calves may be weaned now, but a common practice is to allow them to run with their dams until the early rains. Where supplementary feed is available, April to June are probably the best months of the year for cows to calve in. These months also suit the dairy farmer. Provide succulent feed for the dairy herd. Dry off cows which will not pay for a grain ration during the winter. Bullocks for winter fattening should be selected now.

Sheep.—The ewes should be kept in good shape for lambing. Put the big udder ewes on the green feed.

TOBACCO.

The grading of the brighter grades should be proceeded with as soon as convenient. All leaf which has cured green should be bulked separately and be regularly examined to avoid serious damage through overheating. Tobacco seed heads, when mature, should be removed from the plants and stored where no damage will occur through activities by rats and mice. Care should be taken to store these seed heads with the pods uppermost, as otherwise much seed may be lost. Clear and plough the land soon after the crop has been harvested. Burn old stalks as a control measure against possible carry over of disease.

May.

BEE-KEEPING.

Last month under normal conditions should have seen the last honey flow of the season almost ready for robbing, for which purpose have the extractor overhauled, spare crates available, bee escape boards ready, honey jars and bottles ready for usage, and also have a few spare quilts on hand. Do not rob the bees of too much honey, remembering that sending them into winter quarters with a sufficiency of food means a strong issuing colony in the spring. Any new swarms that it may be decided to add to the apiary, feed well if necessary, to induce stimulative breeding while there is time, or if new young queens have replaced older ones also feed liberally this month in the proportion of one part of cane sugar to two of water; for the somewhat wild Rhodesian bee there is nothing like the Alexander feeder let in from the back. Keep all the spaces under hive stands clean, also inspect daily to see that white ants are not building up from the soil; if this is neglected much loss may follow. When seen, sprinkle diluted kerol from a watering can under the hive stand.

Granulation in the bottled honey can be prevented by first ripening the extracted honey in large tins covered with butter muslin for three or four days by exposure to the sun's rays. It should then be heated to a temperature of 150-160 degrees—nothing higher. As soon as this is reached withdraw the tins and bottle when cooling. The best way to obtain this heating is to place the tins in another receptacle of cold water and boil it up to the required heat, as heating it direct over a fire is very liable to burn the contents or to impair the delicate flavour of the natural honey.

CITRUS FRUITS.

The harvesting of the early ripening fruit should be commenced about the first week in May. Exporters should cure their Washington Navels for a longer period than usual; this will enable them to detect the thick skinned fruit easily. Where necessary, irrigation should be continued up to within ten days of harvesting. All ploughing and cultivation should be completed without delay.

CROPS.

Continue to cut and stook maize as it matures; make the stooks small to assist drying. Later in the season the stooks may be made larger. See that the stooks are secure and pick up plants lying on the ground. Continue to plough up land between stooks of maize. Give all maize harvested, whether husked or in the husk, a chance to dry out before riding to the dumps. Do not begin shelling if the ears are still damp. Do not use new

grain bags for harvesting maize. Make the dumps of unhusked ears as small as possible; the smaller the dump the quicker the grain will dry out. Grain on the cobs dries extremely slowly, if at all, in dumps of large size. Do not mix unhusked ears from the stooks with dryer ears harvested later from the standing crop. Keep the dryer ears in a separate dump; shell, bag and stack such maize separately. When cutting maize for stooking, insist on the stalks being cut within 2 to 4 inches of ground level. The plough, in Rhodesia, will not bury roots with stalks 8 to 12 inches high. A long stubble of stalks makes clearing of the ground for ploughing very tedious and expensive. If not already harvested, ground nuts should be lifted before the first frosts damage the hay. Finish transplanting onions from seed-beds. If plants are not flourishing after transplanting, give a light dressing of nitrate of soda—50 lbs. per acre. Repeat in a fortnight if needed. Sow most winter cereals on wet vleis or under irrigation early this month. Feed your sweet potato vines to stock; if frosts occur the vines will be killed. Dig and feed tubers from end of month onwards. Towards end of month harvest cattle pumpkins and melons and handle carefully; avoid bruising to prevent rotting. Place pumpkins and melons in a dry situation in the open and in a single layer. Supply plenty of roughage to cattle pens, kraals and stables to increase the manure supply. Collect and cart manure to lands for spreading. Do not attempt to plough in dry grass or quantities of maize refuse. The plough will not turn it under and it will not rot before next planting season. Burn such refuse and make a good job of the ploughing. If the weather seems set fair, commence brick-making. A small kiln of bricks always on hand is most useful. As labour permits, re-thatch buildings and outhouses in need of repair. Overhaul, grease and paint planters, drills and other implements not required again until next season, and store away under cover. Think about your fertiliser requirements for next season and place your orders. From now onwards the second ploughing of new land broken up earlier in the season should be pushed on with as opportunity offers.

DECIDUOUS FRUITS.

The pruning of early ripening peaches should be performed this month. All holes should be completed and kept in readiness for June planting. Ploughing or digging and cultivation should be completed without delay.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family are liable to suffer greatly from cabbage louse (aphis) and Bagrada bug during May. For the former wash the plants frequently with a strong stream of cold water from a spray pump, or spray with soap and tobacco wash. Transplants may be dipped in the latter. Plants attacked by Bagrada bug may be sprayed with resin wash when the young bugs are exposed in the early morning.

Citrus Trees.—Continue to collect and destroy all fruits infested with citrus codling. Fumigate or spray for scale insects if necessary.

Guava.—Fruit fly and citrus codling breed in these fruits during the autumn and winter. Collect fruit and destroy.

Tobacco.—Watch should be kept for the emergence of the adult wire-worm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20 to 30 gallons of water. The bait should be rolled into small balls and scattered on the lands, one ball to each ten square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 10 lbs. per 10 gallons. The bait is best laid in the evening.

Fields of tobacco found to be heavily infested with gallworm should be thoroughly ploughed and cross-ploughed and laid down to an immune crop next season.

Cotton.—Continue trapping and destroying stainers. All dropped bolls should be collected and destroyed.

Maize.—Clean up storage sites, sidings and sheds against weevil.

Potatoes.—Late potatoes should be kept earthed up to prevent tuber moth from attacking the tubers.

FLOWER GARDEN.

The month of May is a suitable one for the preparation of new flower beds. The ground should be well trenched, and if of poor quality, a light dressing of well rotted manure will be a distinct advantage. Too heavy dressing is not advised, as too rich a soil is likely to produce an abundance of foliage and very few flowers. It is not too late to sow sweet pea seeds, but the best results come from early planting. By this time all bulbs for spring flowering will be planted. Chrysanthemums, delphiniums, dahlias and other herbaceous perennials may now be cut down, and if necessary taken up, divided and replanted

VEGETABLE GARDEN.

It will be necessary during the early part of the month to clear off what remains of summer crops, such as haricot beans, peas, cucumbers, etc. Where winter deep rooting vegetables are to be grown, such as carrots, parsnips and beets, the soil and sub-soil should be deeply worked, so as to allow a ready root run for these vegetables. A dressing of lime will be of great value in every section of the kitchen garden. This will especially help to minimise future attacks of insects and fungus attacks. New asparagus beds may be made this month; old beds should be cut down, cleaned and kept in good order; also a light dressing of stable manure may be given to the beds. Planting may be made of all seedlings, such as cabbage, cauliflower, lettuce, onions, etc., and seeds of carrot, leek, lettuce, onions, peas, radish, turnip, parsnip, broad beans may be sown.

FORESTRY.

Continue pricking out coniferous seedlings into tins or beds. Deciduous trees which are propagated by means of cuttings should be taken in hand. See that the fire lines are in order, and in the case of woods which have formed canopy, remove inflammable material below the edge trees.

POULTRY.

All cockerel chickens should be separated from the pullets, and every month gone over carefully, the poorer ones eliminated and only the very best kept. Those cockerels with the deep long bodies, short legs and round heads should be kept. Those with any inclination to long legs, knock knees, long heads or thin beak, lop-over combs, narrow bodies, or those lacking length and depth should be rigorously discarded. The chickens must not be allowed to become chilled, especially at night; on the other hand, they must not sleep in a hot stuffy atmosphere. On no account must they be overcrowded; this is fatal and is one of the many rocks on which poultry keepers come to grief.

The young stock must have all they can eat; to stint them is to ruin them for good and all. A bird that has been stunted never recovers. A good quality bone meal (lime phosphate) is absolutely necessary, as is also plenty of succulent green food, and no animal protein is better than thick separated milk for the health and growth of the chickens.

Those going in for ducks should hatch according to the numbers they have to supply for eating each week. Ducks must have all the food they will eat from the time they are hatched. A quick-growing duck should put on 1 lb. per week and be ready for killing at from seven to eight weeks old. Always kill or sell for killing just before the large wing feathers commence to grow.

If the rains have stopped, turkeys can be hatched. See that the youngsters are kept warm, but also that they have plenty of fresh

air. Never feed young turkeys on wet or moist food, but give dry mash, grain, plenty of onion tops or onions chopped small, and thick separated milk. Keep them free from insect vermin; they will never thrive if they are infested with these.

Never allow the hen that has hatched the turkey eggs to run with the youngsters. Always confine her in a coop, through the slats of which the young turkeys can run in and out. The coop should be moved to fresh ground each day; nothing is worse for young turkeys than to be running on the same piece of ground for long at a time. Tainted ground is one of the chief causes of mortality among young turkeys.

STOCK.

Cattle.—By the middle of this month dairy cattle will require more serious attention in the matter of feed. Grass should be cut for bedding, and both cows and calves should be well bedded down at night from now onwards, and cowsheds should be put in good repair. Attention should be given to the water supplies, and care taken that they are clean and sufficient.

Boggy sources of water supply are a frequent source of loss of cattle during the winter months. With adequate water supplies cattle can withstand considerable shortage of grazing. Weaners should be fed a good roughage ration—with or without a small allowance of grain, depending on circumstances—to keep them growing through the winter months.

Get in the bullocks for winter fattening.

Sheep.—The ewes should be lambing now. It is the general experience in the Colony that winter lambs are better than spring ones. Adequate feed must be provided to keep up the milk flow of the ewes. For this purpose a stand of winter oats or barley, on which the ewes can graze for an hour a day, is excellent. A little maize with a legume hay will also give very good results. Where roots do well, they will make a valuable succulent feed for sheep. The sheep should have access to some shelter from the cold winds. Dock the lambs.

TOBACCO.

Curing should be completed as early in the month as possible to prevent loss from frost. The bales of tobacco should be examined and turned weekly until they are despatched from the farm. All bulks must be inspected regularly and turned if necessary. Tobacco seed should be shelled as soon as the seed pods are dry and the seed carefully labelled and stored in a dry place. The stumping, clearing and ploughing of new land, if operations have not already been commenced, should be no longer delayed. Land which has just produced a crop should be ploughed and harrowed as soon after the harvest as possible.

VETERINARY.

Horse-sickness will still be in evidence, and may be expected to continue until the frosts occur. Inoculation for blue tongue should be performed in the dry season only, unless the animals can be kept under cover for 21 days. Do not inoculate ewes in lamb on account of abortion. Inoculated animals spread the disease for 21 days. Scab is a poverty winter disease.

WEATHER.

During the major portion of this month the ordinary winter conditions prevail, viz., cloudless sunny days and cold nights. Frost may be normally expected at any time during the latter half of the month. There is often, however, a recrudescence of rain conditions during the early portion of the month, resulting in overcast days and light drizzling showers, the normal rainfall at many places, particularly in the southern and eastern portions of the country, amounting to over half an inch.

SOUTHERN RHODESIA WEATHER BUREAU.

FEBRUARY, 1932.

Pressure.—Barometric pressure was consistently low towards the end of the month, and the mean pressure varied from normal to 1.5 mb. below normal.

Pressure movements were highly irregular and interesting. The equatorial low was rather to the east of its usual position on the 1st and it moved slowly eastwards crossing the coast to the south of Mossuril and lay in the Mocambique Channel on the 3rd and 4th, and then appears to have traversed Madagascar and disappeared. Cyclones were active during this period and it is believed that they "attract" the equatorial low. Lows were inactive until the 19th, when the equatorial low spread over the Union; it deepened in the east on the 20th and then withdrew to the west. On the 23rd a deep low was on the S.E. coast, which spread out on the 24th. On the 25th the equatorial low affected Southern Rhodesia; it then extended to the S.W. Cape and only weak movements occurred to the end of the month.

A high moved up the east coast on the 2nd and 3rd, and remained in the Limpopo Valley from the 4th to the 18th continuously; it then withdrew to the east and remained over Madagascar for a period. A weak high appeared in the west on the 19th and affected the S. coast for two days. The last high appeared in the west on the 24th; it showed as high pressure along the coast on the 25th, deepened in the south-east on the 26th and moved up the coast, being off Beira on the 28th and 29th.

The temperatures of the month were generally slightly above normal.

Rainfall.—The mean rainfall for the month amounted to 4.7 inches, approximately 1 inch less than normal, and the seasonal total to the end of February is 20.8 inches, or 2.2 inches below normal.

The distribution in February was as follows:—

	February, 1932.	Normal, February.
Zone A	3.6	4.8
Zone B	3.2	3.7
Zone C	5.3	6.9
Zone D	6.8	7.1
Zone E	3.6	6.4
Zone F	5.4	10.2

Rain Periods.—Showers were numerous in the north-east on the 1st and 2nd, with scattered showers from the 3rd to 5th. Rain increased in Mashonaland from the 6th to the 12th, and it was generally fine from the 13th to the 15th. Showers were numerous on the 16th and continued numerous to fairly general to the end of the month.

FEBRUARY, 1932.

Station.	Pressure Millibars, 8.30 a.m. Mean.	Pressure Normal.	Temperature in Stevenson Screen ° F. Absolute. Max.	Absolute. Min.	Mean. Max.	Mean. Min.	Mean. ½ Max. Min.	Mean. Nor-mal.	Mean. Dry Bulb.	Mean. Wet Bulb.	Rel. Hum. %	Dew Point F.	Cloud Amt. 0-10	Precipitation. Ins.	Precipitation. Nor-mal.	Precipitation. No. of Days.	Alti-tude (Feet).
Bulawayo ...	867.0	867.0	90	56	82.7	61.5	72.1	70.3	69.9	63.3	69	59	6.5	2.96	4.1	11	4,436
Gwelo	860.7	...	88	54	81.2	60.3	70.8	70.9	69.0	63.7	75	61	4.7	2.39	5.3	9	4,632
Riverbank ...	...	...	95	58	85.9	62.7	74.3	73.5	72.0	65.3	70	62	...	3.87	4.5	10	4,100
Essexvale ...	...	...	100	59	88.8	64.6	76.7	72.9	71.5	65.4	72	62	...	2.07	5.2	6	3,828
Gwanda ...	904.1	...	94	61	86.5	64.7	75.6	...	73.8	66.1	67	62	3.6	2.70	3.7	8	3,235
Mazunga ...	945.7	947.2	98	59	89.3	66.1	77.7	78.3	76.3	69.4	71	67	6.0	4.54	3.2	7	1,970
Nuanetsi ...	...	...	99	58	90.4	66.8	78.6	...	76.1	70.1	74	68	6.9	1.07	2.2	4	1,630
Between Rivers	...	...	89	57	82.4	61.5	72.0	...	69.4	65.8	83	64	5.9	3.38	4.8	13	3,970
Enkeldoorn ...	...	...	86	54	79.6	59.3	69.5	69.7	68.5	63.3	75	61	6.3	2.55	6.2	10	4,720
Gatooma ...	...	...	91	56	85.0	61.1	73.1	73.8	72.3	66.8	75	64	4.8	3.85	7.7	13	3,850
Miami	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4,090
Salisbury ...	853.2	854.2	86	54	78.9	59.9	69.4	69.4	68.0	63.2	76	60	7.5	3.85	5.2	15	4,865
Sinoia, Citrus ...	...	...	87	59	81.4	62.5	72.0	...	71.1	66.5	79	65	...	4.75	7.3	12	3,830
Sipolilo... ...	...	...	87	60	79.6	63.6	71.6	...	70.9	65.9	77	63	5.8	6.04	8.2	16	3,900
Juliasdale ...	...	...	79	50	72.2	55.7	63.9	63.1	66.0	62.0	80	60	...	7.10	7.9	13	6,070
Mtoko	...	...	82	59	79.3	62.9	71.1	...	69.5	65.0	78	63	6.7	5.87	5.6	9	4,210
Shamva ...	...	...	91	61	80.5	65.3	72.9	...	72.8	68.7	81	67	6.4	7.33	7.5	15	3,170
Angus Ranch ...	...	...	96	63	88.2	68.8	78.5	76.4	76.9	70.0	71	67	...	4.63	4.1	9	2,300
Craigendoran ...	...	...	97	56	88.6	64.7	76.7	...	76.8	69.4	69	66	...	2.43	5.6	11	3,430
New Year's Gift	...	...	91	59	84.3	64.3	74.3	...	73.2	67.5	75	65	...	2.88	5.0	7	2,700
Nyamasanga ...	...	...	82	50	79.0	58.0	68.5	...	69.2	62.7	69	59	...	6.03	...	13	5,680
Riverdene North	...	...	93	50	86.0	60.8	73.4	...	72.8	66.1	70	63	...	2.06	4.3	10	3,700
Stapleford ...	...	...	78	47	72.2	55.3	63.8	...	64.3	61.2	84	59	6.8	13.49	16.9	19	5,450
Umtali	890.7	891.1	88	57	81.2	62 3	71.8	71.5	71.4	66 0	75	63	5.4	4.99	6.3	14	3,677
Victoria ...	893.6	894.2	90	53	83.1	61.8	72.5	71.5	72.7	65.3	67	61	5.5	1.54	5.0	8	3,570
Melsetter ...	848.8	...	80	51	75.4	58.0	66.7	...	66.7	62.3	78	60	5.1	4.43	9.0	14	5,060
Mount Selinda	...	...	85	58	77.7	62.7	70.2	...	67.8	65.0	86	62	6.4	7.94	11.7	15	3,520

NOTES FROM THE "GAZETTE."

"Gazette" Date.	*Items.*
	DEPARTMENT OF AGRICULTURE.
11.3.32.	It is hereby notified for public information that the following scale of charges will apply for analysis by the Chemical Laboratory:—

	£ s. d.
Partial analyses of soil samples from bona fide farmers to determine suitability for crops, and/or to make manurial recommendations ...	Free
Complete analysis of a soil sample, including report and recommendations ...	4 4 0
Partial analysis of any unregistered fertiliser or feeding-stuff, for each constituent ...	0 15 0
Partial analysis of a registered fertiliser or feeding-stuff, taken according to provisions of Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance ...	1 1 0
Complete analysis of any unregistered fertiliser or feeding-stuff ...	3 3 0
Complete analysis of a registered fertiliser or feeding-stuff, taken according to provisions of Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance	4 4 0
Analysis of water for agricultural purposes ...	0 10 6
Limestone, estimation of lime content ...	0 10 6
Limestone, complete analysis ...	1 1 0
Milk, cream or butter, for each constituent ...	0 10 6
Milk, cream or butter, complete analysis ...	1 1 0
Cattle dips ...	0 10 6
Viscera of animals—arsenic ...	0 10 6
Viscera of animals—strychnine, cyanide, nitrates or copper ...	1 1 0
Viscera of animals—general examination for poisons, from ...	3 3 0 (depending on time involved.)

Samples to be delivered free of cost to the Department and to be accompanied by remittances for analysis required. No modification or remission will be made in any of these fees, except with the authority of the Minister of Agriculture.

GWEBI PRODUCE PRICES.

Hull-less oats	40/- per bag of 150 lbs.
Large Black sunflower seed ...	14/- per bag of 100 lbs.
Dolichos beans	35/- per bag of 200 lbs.
Linseed	60/- per bag of 200 lbs.
Linseed (quantities under 100 lbs.)	4½d. per lb.
Sweet potato tubers (Calabash Leaf)	6/- per bag of 150 lbs.
Napier fodder roots	6/- per bag of 40 lbs.
Sweet potato cuttings (Calabash Leaf)	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.
Pumpkin seed	1/1 per lb.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

DEPARTMENTAL BULLETINS.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.

No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.

No. 429. Propagation of Kudzu Vine, by H. C. Arnold.

No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.

No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.

No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.

No. 550. Onion Growing under Irrigation, by C. Mainwaring.

No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.

No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.

No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.

No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.

No. 630. The Storage of Seed Potatoes, by H. C. Arnold.

No. 634. Barley, by P. V. Samuels.

No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.

No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.

No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.

No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.

No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.

No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.

No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.

No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).
No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.
No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.
No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.
No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.
No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.
No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.
No. 759. Witch Weed (Striga Lutea): Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.
No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.
No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.
No. 781. Agricultural Costings at the Gwebi Farm—Maize and Green Manuring, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.
No. 783. Agricultural Costings at the Gwebi Farm—Fattening for Beef, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 787. Agricultural Costings at the Gwebi Farm—Ground Nuts and Maize and Beans for Silage, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 793. Agricultural Costings on the Gwebi Farm, by H. G. Mundy, Dip.Agric., Chief Agriculturist.
No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.
No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.
No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.
No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.
No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
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EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Do Tsetse Flies Feed on Plant Juices?—Recently there appeared in the press an account by Dr. E. Warren, Director of the Natal Museum, of certain experiments and observations which had been carried out in Zululand on the feeding habits of the tsetse fly *Glossina pallidipes* and on the flagellate, the causal organism of the disease "nagana" or trypanosomiasis, transmitted by the fly to domestic animals. Dr. Warren states that in nature *G. pallidipes* feeds not only on mammalian blood, but also feeds normally on the juices of certain plants of the family *Euphorbiaceæ*. Flies when fed on latex alone have been kept in a state of good health for 38 days, proving that the fly is not dependent on blood and indicating that it is not possible to exterminate the fly by starvation by the eradication of game. It is further alleged that the trypanosome causing nagana has been discovered in the latex of plants used by the fly as a source of food, that these trypanosomes are transmitted to the fly during

feeding and that these flies eventually become infected with trypanosomes having all the morphological characteristics of the nagana trypanosome.

It is not possible to judge from the press reports whether there is any real foundation to the alleged discoveries, as no details are given of the experiments. The very fact that wild flies were apparently being used in the transmission experiments entirely invalidates them as scientific experiments, because under natural conditions approximately ten per cent. of the tsetse flies are infected with the "nagana" trypanosomes. There are a number of authenticated records of flagellate organisms occurring in the latex of plants, including a few South African records, but so far no true trypanosome has been recorded from plants. These leptomonad-like organisms are probably transferred from plant to plant by certain plant-sucking bugs. One doubtful record exists of such an organism being transmitted by a bug to a mammalian host. There are also records, one from Nigeria and one from Southern Rhodesia, of the tsetse fly *G. morsitans* being infected with a leptomonad flagellate in the proboscis and gut. This flagellate differs considerably from the non-trypanosome (crithidia) forms of the nagana organism which occur in the tsetse fly during cyclical development. The source of these infections is not known.

As long ago as 1913 Dr. G. D. Hale Carpenter, when working with another species of tsetse fly (*G. palpalis*), recorded the presence of starch grains in the gut of dissected flies and produced strong evidence that it feeds on plant substances. *G. morsitans* in Southern Rhodesia has been observed on many occasions to probe with its proboscis at inanimate objects, such as the hessian covering of a trap, a wooden box, the boots or leggings worn by an observer, etc. In fact, a hungry fly, when attracted to a hessian screen or the wooden walls of a trap, will alight with its head down and nearly always commence probing immediately. In this way this well-known habit might account for the fact that starch grains and other foreign bodies are occasionally ingested by tsetse flies.

In Southern Rhodesia during the last few years nearly 3,000 wild flies have been dissected and microscopically examined. None of the unmistakable, large, dumb-bell

shaped starch grains, stated by Dr. Warren to have been found in the gut of the flies used in the Zululand experiments, have been seen in gut smears made in this Colony. Admittedly in the areas where the Rhodesian dissections were made latex-bearing Euphorbiaceous plants are not common, but they do exist, and it is improbable that such striking bodies would have been overlooked if present.

Apart from the question of the source of infection of the tsetse fly, according to the Zululand experiments, flies were kept alive in good health for 38 days when fed on latex alone. It has been known for some years that tsetse flies could live under certain favourable conditions of humidity and temperature for at least ten days without feeding, but under laboratory conditions a feed is usually given every three to four days. Experiments recently conducted in Tanganyika suggest that under natural conditions the fly feeds about once every five days on blood. There is already some microscopic evidence that flies will imbibe water, and therefore, if blood cannot be obtained, it is possible that the fly can exist for quite a long period without a feed of blood. Experience in Southern Rhodesia, however, definitely shows that a considerable reduction in the tsetse fly density invariably follows immediately on game reduction.

At least eighteen species of African mammals are known to be hosts of the pathogenic trypanosomes. The cyclical development of these trypanosomes in the tsetse fly, followed by another form of multiplication in the blood of the mammalian hosts, is a definitely established fact. If plants also act as intermediate hosts for the trypanosomes the problem becomes more involved than ever.

The publication of the details of the Zululand experiments in the scientific press is awaited with great interest, and it will be interesting to see if all the assertions accepted by Dr. Warren are confirmed.

Tsetse Fly Operations.—A recent development in the campaign against tsetse fly is indicated by the appointment of Mr. W. R. Benzies, with effect from the 1st April, as

officer in charge of all arrangements for the destruction of game.

It is thought possible that, in view of the very scattered nature of these operations and of the diverse conditions under which they are at present being carried on, greater economy may be obtained by placing the control of the whole "front," in as far as the destruction of game is concerned, into the hands of one experienced individual, accustomed to the control of natives and familiar with the ways of the country.

Mr. W. R. Benzies, a senior Native Commissioner of wide experience, is eminently suitable for work of this description, but it is not to be anticipated that his services can be spared from his own Department for any longer period than that necessary to get the work thoroughly organised. Mr. Benzies has already commenced duty and his reports will be of great interest.

A further development is the re-organisation of the cattle camp on the outskirts of the fly area near Gatooma. This camp has been placed directly under the charge of the Veterinary Research Department, as the primary object to be attained is the methodical treatment by injections of cattle exposed to trypanosomiasis, with a view to determining the best conditions under which they can be maintained in a healthy and workable condition. It is known that these injections have in many cases been very successful; in other cases they have been less successful, and in some cases they have been apparently unsuccessful; and the desire of the Department is now to ascertain to what extent under proper precautions animals can be kept in good condition whilst exposed to the attacks of tsetse fly in various parts of the country.

The experience obtained in Gatooma will be tested out under suitable conditions in other areas, such as Mount Darwin and Melsetter, where losses of cattle have been reported.

Hull-less Oats.—In the issue of this Journal for March, 1931, attention is called to the series of hull-less oat selections which were being tested on the Salisbury Experiment Station.

From a chemical analysis which was given it was evident that the protein content of this type of oat was considerably higher than the usual type of hulled oats, being about 18 per cent. in the former and 15 per cent. in the latter.

A sample of hull-less oats was sent to the Imperial Institute by the Chief, Division of Plant Industry, for favour of report. This was submitted to the London Corn Trade Association, who reported as follows:—

> "The sample of hull-less oats is decidedly inferior to the samples of Scottish and Canadian shell-less (or shelled) oats at present being traded in.
>
> "There is a special trade for this type of grain from January to June arrival each year, and during the past year prices have varied between 9s. and 14s. per cwt. landed. On the sample received, we should say that at 1s. 6d. per cwt. less these Rhodesian hull-less oats would take the trade—that is to say, had they been on offer from January to June arrival this year, there would have been possibilities of business in small parcels at from 7s. 6d. to 12s. 6d. per cwt. landed. When this special trade is finished, the values drop considerably, and they have to compete with ordinary grinding oats suitable for the small country grinders, and the value at the present time of the year would certainly not be over about 6s. to 7s. per cwt. landed.
>
> "The trade in this article is decidedly a special one, and various country grinders will quote anything up to 5s. per quarter difference in value, according to their plant and their trade; but from January to June arrival each year there should be a possibility of finding a market for a series of small parcels at a fair price."

It would appear probable that this report was based entirely on the external appearance of the grain, and that no consideration was given to the protein content or general feeding value. Had this been taken into account, it is anticipated that the report might have been more favourable.

Several of the newer varieties undergoing trial on the Salisbury Station promise to yield larger and plumper grain which would probably secure a better price on the London market. At 7s. 6d. per cwt. landed in London the crop would

not prove profitable, but at 12s. 6d. to 15s. per cwt. hull-less oats would prove a comparatively profitable crop to produce.

Until further samples have been submitted and a further report obtained, the attention of poultry keepers in particular is drawn to the high feeding value of hull-less oats compared with maize or munga, as the protein content of the former is from 50 to 90 per cent. greater than in the other two grains.

New Light on Virus Diseases.—Special attention is being paid to the study of virus diseases by the scientific research workers at the National Institute for Medical Research at Hampstead, and also at the Lister Institute, London.

The nature of the viruses concerned in human diseases (such as small-pox and influenza), domestic animals (such as foot and mouth disease), poultry (by fowl-pox) and plants (such as the virus diseases of tobacco, sugar, potato, etc.) remained almost a complete mystery until a few years ago. They were known to pass through the finest porcelain filters and to be invisible under the highest powers of the microscope, and could not until recently be artificially grown. Recently a special ultra-violet ray microscope has been designed by one of the scientists at the Hampstead Institute, and it has been found that by this means viruses which could not be clearly seen or photographed in ordinary light can now be photographed. A means has also been discovered of propagating different viruses in the laboratory on living cells taken from animals and kept alive in cultures.

Special attention is being given to the virus of foot and mouth disease. Three distinct types of this disease are recognised in England, and the method of immunisation is complicated by the fact than an animal which is immune to one type is still susceptible to the other two. It is possible that the strain of the disease in this country represents another distinct type, and it would be of interest to get the opinion of the scientific workers at the two research laboratories on the particular type of foot and mouth disease found in this country.

The investigations into the virus diseases of plants are being concentrated at Rothamsted Experiment Station. At

this institution Dr. Henderson-Smith is paying particular attention to the relationship between the viruses concerned in plant diseases and the insects by which they are transmitted. It is considered possible that in some cases the virus concerned in plant disease may require the insect host for some phase of its development. If this should be found to be the case, it would accentuate the similarity between certain diseases of animals transmitted by insects and the virus diseases of plants.

Maize in Kenya.—A very interesting account of the maize position in Kenya by Mr. Colin Maher is published in the March number of *Tropical Agriculture*.

The total European production during 1929-30 amounted to 1,858,586 bags, and it has been estimated that the total native production for the same year was 1,387,104 bags. Prior to 1910 maize was not exported from Kenya, but in 1912-13 about 115,000 bags were disposed of in Great Britain.

The highest export so far recorded occurred in the 1926-27 season, when 1,100,000 bags were exported. The Kenya Flat White maize, which is almost entirely grown for export, is a hybrid derived chiefly from Natal White Horse Tooth and Hickory King.

The greater part of the maize crop of Kenya is grown in the Highlands ranging from 5,500 to 6,500 feet.

As the Equator passes through Kenya Colony, the length of day varies very little from about 12 hours during the year, and this fact in conjunction with the altitude means that Kenya maize requires eight to nine months to mature.

The average acreage put under maize by individual farmers is large, varying from 200 to 3,000 acres. Under the present system of one-crop farming, an economic unit appears to be 800 acres. The cost of maize growing in Kenya varies considerably from farm to farm.

A recent investigation by the Department of Agriculture indicates that the cost per acre varies from 35s. to 67s. 6d., including bags and transport, and the conclusion is reached that for successful maize farming yields of at least 13 bags

per acre are essential if any profit is to be made when the European price remains at about 25s. per quarter.

The average annual yield per acre during the last 10 years has been about 6.5 bags, and it is stated that the general employment of intensive and improved farming methods in Kenya, involving the keeping of stock and the practice of green manuring, must be extended before maize growing under normal conditions can be looked upon as a profitable line of farming.

Cleaning Seeds.—A new method of cleaning seeds which may prove to be of commercial importance has been discovered by research workers at the University of Toronto. By recognising and making use of a physical characteristic of seeds which apparently was overlooked previously, it has been found possible practically to eliminate weed seeds in lucerne, sweet clover, red clover and alsike. The apparatus required is extremely simple, being little more than a rotating band and a tub of water. The investigators observed a slight difference in the facility with which seeds can be wetted with water. It was found that after the fodder seed was wetted to a slight extent its "wetability" had attained the maximum, whereas the weed seed continued to be wetted. By the addition of certain re-agents which will accentuate the difference of "wetability," it is stated that separation of weed seeds from the fodder seeds will be commercially possible.

REPORT OF THE DIVISION OF PLANT INDUSTRY

FOR THE YEAR 1931.

By H. G. Mundy, Dip.Agric., F.L.S.

Correspondence and personal interviews have decreased to a marked extent during the year, partly due to the virtual cessation of the flow of new settlers into the Colony, and partly to the fact that the majority of newer comers still carrying on actively have now acquired a considerable measure of farming experience.

The curtailment of activities resulting from economy measures has affected the Division severely. Apart from reductions in staff, the following operations have been totally discontinued:—

(a) Cost accounting on the Government Farm, Gwebi.

(b) Maize experiments conducted at the same centre on behalf of the Rhodesia Agricultural Union, and mole draining trials on arable land.

(c) A wide series of investigations covering various aspects of crop production on the sand veld with all the principal crops of the Colony, other than tobacco, commenced in 1929 on the Research Farm, Marandellas.

(d) An enquiry into the economics of sand veld farming on the commercial section of the same farm.

The closure of these various activities is the more to be regretted, in that they have been continued for so short a period as to yield no informative results.

This is particularly true of the cost accounting at the Gwebi Farm, which has entailed a considerable expense and

a great deal of painstaking labour on the part of a number of officials, practically to no purpose. The usefulness of the farm has been seriously affected by the constant changes in policy from which it has suffered during the past twelve years.

Travelling.—The virtual discontinuance of district tours and farm-to-farm visits, due again to financial stringency, has temporarily broken down the long and intimate association which the officers of the Division have maintained with the more closely settled farming areas. Lack of an agricultural extension service renders this personal contact between headquarter officers and the farmer of the utmost importance, and it is hoped that circumstances will not cause the interruption to be long continued.

Re-organised Research Work.—The research programme of the Division has been reviewed during the year, and in certain directions has been placed on a more satisfactory footing. The training of apprentices on the Tobacco Experiment Station, Salisbury, was discontinued, the pupils and the late manager (Mr. C. A. Kelsey Harvey) being transferred to the Matopo School of Agriculture, while the tobacco research work conducted for one season at Marandellas has now been made the primary function of the Salisbury Tobacco Research Station, towards the cost of which the Empire Marketing Board has generously donated a grant of £1,500 a year for two years. The investigations in progress formed the subject of discussion between the Chief Tobacco Expert while in England in the early part of the year and the technical advisers of the Board, and are of a nature calculated to assist very materially the tobacco industry of the Colony, and it is believed of neighbouring territories also.

The Botanical Branch has commenced a programme of investigations involving enquiry into the following economic problems:—

(a) The stock-carrying capacity on normal red maize land of some nine of the most promising native grasses.

(b) The possibility of securing by selection and crossing improved vegetative and seed yielding types of *Digitaria* spp., *Urochloa* spp. and *Brachiaria* spp.

(c) A more intimate study than has yet been possible of upwards of forty other of the more promising native grasses.

The practical importance of this work is exemplified by the fact that grazing experiments already carried out at the Agricultural Experiment Station, Salisbury, on two-third acre paddocks of woolly finger grass and Hunyani grass (*Chloris gayana*), situated on red doleritic soil, indicate that under normal rainfall conditions two acres of the former will carry three mature beasts from the 15th December to the 15th April, and that half an acre of the latter will provide sufficient pasturage for one similar beast from the 1st January to the 15th April.

Apart from his normal duties in connection with the recurrent plant diseases of the Colony and new diseases which periodically make their appearance, the Plant Pathologist is co-operating with the Agriculturists in an endeavour to test out more thoroughly the possibilities of the artificial inoculation of legumes which normally fail to produce root nodules, and whose growth—probably for this reason—under local conditions leaves much to be desired. Special attention is being given to the influence of this treatment on soya beans in the hope that in conjunction with the plant breeding in progress it may be possible to establish soya beans as a major legume crop for the Colony.

Witch Weed.—Enquiries into economical methods of controlling the maize parasite witch weed (*Striga lutea*) have been continued, and an informative progress report on the subject was recently published in the Journal by Capt. S. D. Timson, M.C. Apart from successful trap-cropping with such crops as maize, Sudan grass and kaffir corn, a great deal of valuable information of a negative character has also been acquired, while spraying experiments, particularly with sodium chlorate, have yielded encouraging results. The latter method of control will be further examined during the coming year.

The destruction of certain perennial weeds, notably bachelor's button (*Gomphrena globosa*), by means of chemical sprays has also been investigated, but here results have been less successful.

Herbage Plant Experiments.—The preliminary investigations undertaken on the Research Farm, Marandellas, with the object of ascertaining the best combinations of herbage plants for establishment on the wet vlei soils of Mashonaland have yielded extremely hopeful results. The plots have been established for only one year, but over this period white Dutch clover, Alsike, broad-leaved red clover of several types, cowgrass clover, cocksfoot, Yorkshire fog and several native grasses, including swamp couch (*Hæmarthria fasiculata*) and wild paspalum (*Paspalum scrobiculatum*), have shown themselves particularly at home on this class of land.

Owing to the moist character of the soil, all these species produced luxuriant growth during the winter, and a noticeable feature was the increased vigour and more verdant colour of the grasses where established in combination with white clover. A further hopeful sign for the permanence of the clover stands is the freedom with which these seed, and especially in the case of white clover, the strong resultant growth of volunteer plants.

These experiments appear to offer such promise that during the coming year the range of the work will be extended so as to embrace a very wide range of grasses and legumes in pure and mixed associations, on which the effect of lime alone and lime in conjunction with phosphatic fertilisers is likewise being studied.

Grassland Experiments.—In co-operation with the South African Explosives & Industries, Ltd., a number of experimental and demonstration plots of natural grass veld on private farms have been treated with artificial fertiliser. A Government grant is made towards the expenses of the scheme, and the work is organised by Mr. R. Lindsay Robb, Grassland Specialist to the Imperial Chemical Industries, Ltd., and his assistant, the Marquis of Graham, in consultation with the Chief, Division of Plant Industry. The fencing of the plots is provided by the farmer, who, in return for a free issue of the fertiliser, undertakes to keep the necessary records of the number of grazing days yielded under each system of treatment.

The first applications of fertiliser were not made until February, 1930, but treatment is now in progress on about

eighteen different farms, representing a wide variety of soils and grassland types.

It is as yet too early to express an opinion on the economic aspects of the fertilisation of natural grass veld, or on the ultimate effect on the herbage which this treatment, combined with the close rotational grazing which is being practised, will exert. It is already apparent, however, that cattle evince a preference for fertilised pastures, and that the grasses respond in a marked manner to applications of nitrogen and to complete artificials.

Grass Silage.—As a corollary to the application of fertilisers to natural grassland, and consequent upon the necessity of conserving all surplus growth thus produced in as nutritious and palatable a form as possible, initial experiments were undertaken at Gwebi and the Agricultural Experiment Station, Salisbury, in the making of grass silage. The results were highly successful, and it is evident that the ordinary veld ensiled at the correct stage of growth will yield a succulent fodder closely approaching maize silage in feeding value, and that certain of the natural grasses which can quite readily be established as "cultivated" grassland produce a silage as high in protein content as combined maize and bean silage.

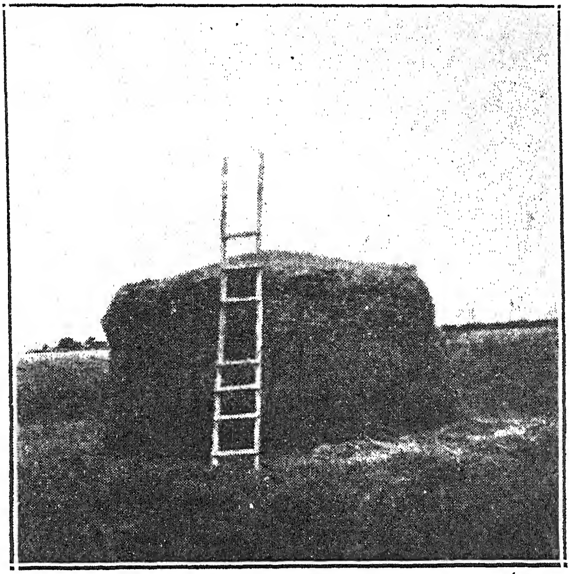
The making of veld grass silage is being undertaken this season on all the Government farms and experiment stations except the Tobacco Research Station, and a number of farmers are also keenly interested in the subject. Thus quite a considerable amount of this kind of silage should be made in the Colony in 1932.

Plant Breeding.—The Plant Breeder has been transferred from the Marandellas Research Farm to the Tobacco Research Station, Salisbury, where he will devote most of his time to the problem of producing strains of tobacco of improved quality, yield and disease resistance. It is hoped, however, that opportunity will still offer to pursue his plant breeding with wheats, on which the preliminary work during the past two years is distinctly encouraging, and to give some attention also to maize.

On the Salisbury Experiment Station work as far as plant breeding is concerned has been concentrated mainly on

the oat and soya bean crops, and in both cases further segregations promise to yield strains distinctly superior to those which have yet been liberated.

Tobacco Industry.—The following extracts from the report of the Chief Tobacco Expert, Mr. D. D. Brown, afford



A stack of vlei-grass silage. Wire netting and sand bags round edge and earth cap. Stack originally up to top of ladder.

additional information regarding the functioning of the Tobacco Branch:—

"The customary duties falling within the functions of the branch have been duly performed, though on a restricted scale owing to financial stringency. During the major portion of the year the staff has not been at full strength. The Chief Tobacco Expert was absent on duty overseas during the first quarter of the year, and the services of a tobacco adviser in Matabeleland were dispensed with on the 31st March, 1931. The Tobacco Adviser, Salisbury, was absent for several months on serious indisposition leave. The Assistant Tobacco Research Officer was granted leave pending retrenchment, which took effect from the 30th November,

1931, and the Foreman, Tobacco Research Station, resigned on the 31st October, 1931.

"The Tobacco Adviser, Salisbury, assumed duty as Officer-in-Charge of the Tobacco Research Station on the 1st September. The Plant Breeder and an assistant were transferred to this station from other posts and assumed duty during the month of October.

"*Seasonal Conditions.*—Speaking generally, the climatic conditions of the past season were not entirely favourable, and in consequence the quality of the tobacco crop was adversely affected, there being a high percentage of low-grade leaf.

"The acreage planted to Hickory Pryor showed a considerable decrease. This is in accordance with the policy, initiated by the Tobacco Branch in 1928, of planting only those varieties considered to be more suitable for market requirements than the local Hickory Pryor strain. The most popular variety of flue-cured tobacco has now proved to be White Stem Orinoco, which produces a type of leaf suitable for oversea requirements.

"Cut worm and wire worm were active this season and did considerable damage, necessitating a great deal of re-planting.

"It is satisfactory to record the increasing attention being given to precautionary measures against mosaic disease. The general adoption of suitable measures should tend to reduce the incidence of this disease, which has increased tremendously during the last decade.

"*Production.*—The production of tobacco over the period 1925 to 1931 has been as follows:—

Season.	Virginia Type.			Turkish Type.		
	Acres planted.	Yield in lbs.	Acre yield in lbs.	Acres planted.	Yield in lbs.	Acre yield in lbs.
1925-26 ...	13,160	5,313,186	404	755	346,623	459
1926-27 ...	29,172	18,631,069	638	992	633,488	638
1927-28 ...	45,711	24,491,464	536	911	451,580	496
1928-29 ...	16,761	6,704,986	400	979	337,478	344
1929-30 ...	9,681	5,494,063	567	787	350,140	444
1930-31* ...	15,297	8,113,000	530	884	409,000	462

* The returns relative to the 1930-31 season are estimates only, final figures not yet being available.

"*Marketing.*—A special visit to the United Kingdom made by the Chief Tobacco Expert under the ægis of the Empire Marketing Board elucidated many important points connected with the problem of marketing Southern Rhodesia tobacco in Great Britain, and considerable improvement in this respect may be recorded as compared with the position in 1930.

"*Research.*—In view of the closing down of the Salisbury Tobacco Experiment Station and the urgent need for economy, the latter station has been handed over to the Tobacco Branch, and is now established as the Tobacco Research Station in place of a similar institution opened at Marandellas during the year 1930. Financial assistance has been granted by the Empire Marketing Board in order to expedite the investigation of the more pressing problems facing the tobacco industry.

"The programme of work proposed for the season 1931-32 includes variety trials, fertiliser experiments, rotation trials and plant breeding, in addition to a series of investigations concerning cultural operations. The main objective of the work as arranged at present is improvement in the quality of the crop.

"Many important investigations have of necessity been postponed until such time as more adequate funds become available.

"In response to requests by farmers' associations a series of variety trials is being conducted under the supervision of the branch on several farms in each of the following districts: Mazoe, Lomagundi, Hartley, Salisbury, Marandellas and Makoni.

"*Publications.*—The following articles were prepared for publication in the *Rhodesia Agricultural Journal*: 'Tobacco Curing—Leaf Method *versus* Stalk Method,' by W. V. C. Evans, B.Sc. (Agr.), Tobacco Adviser; 'Selection of Tobacco Seed Plants,' by H. F. Ellis, M.Sc., B.Sc. (Agr.), Tobacco Adviser; 'Grading and Handling of Fire-cured Tobacco,' by H. F. Ellis, M.Sc., B.Sc. (Agr.), Tobacco Adviser; 'Some of the Problems in Marketing Southern Rhodesia Tobacco,' by D. D. Brown, Chief Tobacco Expert; 'Tobacco Seed Beds,' by D. D. Brown, Chief Tobacco Expert; 'Transplanting of Tobacco,' by D. D.

Brown, Chief Tobacco Expert; 'Seasonal Notes on Tobacco Culture,' by D. D. Brown, Chief Tobacco Expert.

"In addition to the above articles prepared for the *Agricultural Journal*, the Chief Tobacco Expert made several contributions on tobacco matters to the local newspapers, and also prepared special reports describing the historical, economic and technical development of the tobacco industry in Southern Rhodesia for publication by the High Commissioner and by the British Empire Producers' Organisation."

Citrus Industry.—There has been no extension of citrus fruit planting this year, and a decrease is recorded in the export of fruit compared with previous years. The total amount railed for export is stated to be 168,455 cases, of which 53,167 cases were exported via Beira. The previous season's figures were 153,664 cases shipped via Union ports and 29,174 cases by Beira.

The decrease is attributed to frost injury in some groves, low overseas prices and poor crops of Washington navels.

The probable commencement of an export in orange oil, referred to in my last report, has been realised. Oil has been shipped to Great Britain, Germany and the United States of America, has been very favourably reported upon and has sold at prices equal to that realised by the best Sicilian oil. It is understood that the plant is being enlarged for the coming season, and that in addition to an increased output of oil, concentrated citrus juice for export overseas will be included in the products of the factory.

A Salisbury factory has also produced large quantities of bottled citrus juice, which promises gradually to displace the imported article.

The following information is given by the Horticulturist, Mr. G. W. Marshall:—

"*New Markets.*—14,964 cases were shipped to new markets compared with 10,937 cases the previous season. New markets exploited were: Canada, 9,627 cases; France, 1,460 cases; Germany, 2,025 cases; Sudan, 400 cases; Italy, 900 cases; India, 412 cases; Port Said, 90 cases; Greece, 50 cases.

"The average price realised for this year's fruit is not yet available, but from enquiries made it is anticipated that it will be lower than that of previous years. This lower trend in values is apparently due to the abnormal supply of citrus fruits now offered on the world's markets. Great Britain (our chief customer) normally consumes during the summer months about three million cases of citrus fruit, but this year supplies offered have exceeded that amount by one and a half million cases.

"*Deciduous Fruits.*—Little progress is being made in the establishment of deciduous fruit orchards, due to the shortage of funds for purchasing trees. Improvement is noticed, however, in the grading and marketing of fruit.

"Several of the new varieties and selections at present under trial promise to surpass the older varieties, both in respect to quality and yield.

"*Coffee and Tea.*—Most, if not all, of the coffee plantations reported upon by Mr. N. D. Trench in 1929 were visited in June and July, and it is gratifying to record that the plantings have made excellent growth and are now yielding good crops of high class coffee.

"The future of the industry, though limited in extent, may be regarded as fairly assured, and it should expand when the electrically equipped coffee manufacturing plant is completed at New Year's Gift Estate, where most of the Rhodesian coffee will probably be prepared in a manufactured form.

"Favourable reports continue to be received of the tea garden on New Year's Gift Estate, South Melsetter, and Rhodesian tea is gaining in local popularity. Even more encouraging results are being obtained at Ratels Hoek on the Eastern Border, where an experimental planting of a few acres of tea (not under irrigation) promises extremely well.

"*Marketing Farm Side-lines.*—During the first quarter of the year a considerable amount of time was devoted to promoting and assisting in the organisation of a co-operative marketing scheme for fruit, flowers and other farm side-lines. It is pleasing to report that the endeavours were instrumental in the formation of the Producers' Direct Supply Co-operative Company, Limited, which opened its

first store in Salisbury in February with a membership of one hundred; a second store was opened at Bulawayo in October. The membership has increased to three hundred, and the organisation appears to be well launched on a successful career."

Plant Pathology.—Matters of special interest referred to in the annual report of Mr. J. C. Hopkins, Plant Pathologist, are as follows:—

"Three hundred and forty-three lots of infected material were received for diagnosis. This was eleven more than in the previous year and embraced sixty-six specimens, constituting new records of plant diseases in the Colony, of which a number were on indigenous plants. Two hundred and fifty named specimens were added to the herbarium.

"*Investigations.*—Trials for the control of white mould in tobacco by applications of sulphur were laid down on the Research Farm, Marandellas, but no results were obtained owing to the non-development of the disease.

"Preliminary experiments were carried out on the Tobacco Research Station for the control of red rust. It was found, as suspected, that the disease is correlated with height of topping. Further experiments on an extended scale are in progress this season.

"Attempts to determine the cause of 'crinkling' were abortive. No positive results were obtained in attempted transmission of the disease from one plant to another. It is suspected that a virus may be concerned. Similar experiments are in progress this season in connection with the leaf curl disease, but virus work, involving the use of insects, is much hampered by lack of staff and apparatus. Some success has been obtained in differentiating between the different viruses affecting both wild and cultivated plants of the Solanaceæ. A suspected new virus disease on tomato is at present receiving attention.

"The leaf spot of tobacco caused by *Alternaria tabacina* has appeared in epidemic form in several districts during the year, and investigations are being continued into the etiology of the disease with particular reference to solanaceous weeds. A similar *Alternaria* has been found attacking *Datura stramonium*. An infection experiment on tobacco has yielded negative results.

"*Miscellaneous Diseases.*—The constant demands by tobacco growers upon my services have made it impossible for much attention to be given to other economic crops. It has been possible, however, to lay down some small plots to tests various seed treatments for the control of angular spot of cotton, but no further work upon the pathology of diplodia in maize could be undertaken. Trials of alleged diplodia-resistant varieties received from the United States of America have been arranged in conjunction with the Plant Breeder.

"Urgent demands have been received from farmers for investigations to be made into brown fleck disease of potatoes and blindness in barley and wheat, but under present circumstances there is little possibility of our being able to meet these requests.

"*Nodule Bacteria for Soya Beans.*—This branch has undertaken the culturing of various strains of nodule bacteria obtained from different sources, and a project has been drawn up for the testing of the different cultures under local environmental conditions. Trials are now in progress on the sand veld at the Tobacco Research Station and on the red soil at the Salisbury Experiment Station.

"*Publications.*—The 'Handbook of Tobacco Diseases' was completed and published about the middle of the year, and 2,000 copies have been received for local sale.

"The agency for local distribution was given to the Rhodesian Printing and Publishing Company, who are selling the book for 4s., of which 3s. is remitted to the Government. About 160 copies have been disposed of.

A paper on *Alternaria* disease of cotton was published in the December issue of the 'Transactions of the British Society.' The following articles have appeared in the *Agricultural Journal*: 'Plant Pathology in Southern Rhodesia during 1930' (April); 'Mycological Notes—Diplodia' (July); 'Some Common Diseases of Potatoes in Southern Rhodesia' (August); 'Mycological Notes—Care of Tobacco Seed Beds' (October).

"*Movements.*—Extension work has had to be considerably curtailed, and only fifteen farms have been visited during the year, and fifteen visits were paid to the Government Experiment Stations for the purpose of supervising experiments.

"*Agricultural Shows.*—A large exhibit was placed on the Salisbury Show, illustrating methods to be adopted for the control of tobacco and maize diseases. Various types of wet and dry spraying apparatus were shown, which elicited numerous enquiries. It is unfortunate that more time cannot be given to propaganda in connection with the use of modern fungicides."

Botanical Branch.—The following forms part of the annual report of the Senior Botanist, Miss Sydney M. Stent:

"During the year 5,553 specimens of plants have been mounted; of these 3,791 were incorporated in the herbarium; the remainder were duplicates mounted for the Forestry herbarium and for individual collectors. The duplicate herbarium numbers about 1,200.

"With the growth of the herbarium, the work of identifying plants and recording their distribution, habit of growth, etc., has been very greatly facilitated.

"The duplicate herbarium has proved a great asset, the specimens being used not only as plant exchanges with herbaria in other parts of the world, but also in exchange for valuable literature which could not otherwise have been procured.

"In all, 567 specimens have been received from other herbaria, including 340 from the National Herbarium, Pretoria, 100 from Dr. Muir's Herbarium, Riversdale, and 27 from Kew.

"This herbarium has distributed 100 specimens to the National Herbarium, 32 to the Rijks Herbarium, Leyden, and 52 to Kew Herbarium.

"A special collection of common weed seeds and of native leguminous plants has been commenced.

"The whole herbarium has been indexed and the economic and literature indexes are well advanced, and a fairly comprehensive index to local names has been compiled.

"An exhibit of indigenous grasses classified according to their habitat and their economic value was prepared for the Salisbury Agricultural Show; also an exhibit of indigenous or naturalised poison plants. An article on the known

poisonous plants of Southern Rhodesia was prepared for the *Agricultural Journal*, and reprints were made available for distribution in connection with this exhibit.

"The exhibit of poisonous plants excited a good deal of interest among farmers, and reports were subsequently received from Shamva, Marandellas, Sinoia and Hartley of fatality amongst the stock, suspected to be due to plant poisoning. These localities were visited by the Botanist and collections were made of suspicious plants, feeding tests being carried out by the Veterinary Research Department; these resulted in the establishment of one species of plant—*Moreœ zambesiaca*—as being definitely poisonous to stock.

"*Pasture Grass Experiments.*—Small observation and demonstration plots in duplicate have been laid down on the Experiment Station, Salisbury, of the more promising indigenous grasses, one series of which is untreated and the other fertilised with rock phosphate.

"Breeding experiments have been commenced with four species of *Digitaria*, three species of *Urochloa* and two species of *Brachiaria* with a view to producing strains with better vegetative and seeding characters.

"Work in connection with pasture research entailed four visits to Marandellas and three to Matopos, undertaken by Mr. Rattray, Botanist, for the purpose of making botanical analyses and detailed observations of the pastures.

"The herbarium is greatly indebted to the following for valuable contributions to our botanical library: Professor Hitchcock, Senior Systematic Agrostologist to the United States Department of Agriculture; Mrs. A. Chase, Associate Agrostologist; Dr. Henrard, of the Rijks Herbarium, Leyden; Mlle. Aimee Camus, of the National History Museum, Paris; Dr. D. C. Steyn, of Onderstepoort, Pretoria, Transvaal; and the Chief, Division of Plant Industry, Pretoria."

Gwebi Farm.—The fall in commodity prices and the stoppage of export of slaughter cattle to the Union and overseas have adversely affected the revenue of this farm, and early in the year it became apparent that the institution could not long remain self-supporting, unless a material improvement in marketing conditions might be looked for. The output of the various crops raised was regarded by the

Economy Committee as competing unwarrantably with that of private farmers on markets already overloaded. As a result of this combination of circumstances, it was decided, as a first step, to lease off half of the farm, to discontinue cost accounting, which, it is estimated, entailed an extra expense of at least £500 a year over normal running costs, and to restrict crop production to farm requirements.

Approximately 1,600 acres, including about 700 acres of arable land, have been leased for three years at a minimum rental of £300 per annum, and steps have been taken to dispose of a considerable proportion of the grade Friesland herd. Sales of breeding stock have, however, been delayed owing to foot and mouth restrictions.

Climatic conditions in December and January were unfavourable, 20½ inches of rain out of a total of 30¼ inches falling in these two months. Heavy, low-lying land became water-logged, and crop growth was retarded in consequence. The maize yield, however, was 10.2 bags an acre over 507 acres, with a minimum return from any field of 6.5 bags and a maximum of 13.4 bags an acre. The average yield during the past six years has been 10.52 bags an acre.

The systems of rotation and soil management practised at Gwebi have been those advocated by the Division for general adoption by maize growers and "mixed" farmers, and the fact that the yield of the staple crop has been maintained so satisfactorily through several adverse seasons and on soils of very variable fertility, comprising none particularly rich, affords good evidence of the soundness of the methods.

Machine check-row planting of maize on a large scale has been proved satisfactory and economical, and the practice can now be unreservedly recommended.

Live Stock.—Cattle and pigs have continued to do well, though many of the cows in the pedigree Friesland herd are now old and their milk productive powers have dropped considerably. The average number of combined pedigree and grade cows in milk throughout the year was 33.3, and the average milk yield was 22½ lbs. per diem. Production was less than in the previous year, and in this connection the farm manager remarks: "No cows were pushed for milk records, for, taking butter fat at present prices, it is obvious

that feeding for records can only result in loss. On the other hand, records are necessary if pedigree dairy stock are to be bred for sale, and thus we find ourselves in a cleft-stick.''

The imported pedigree Shorthorns have done remarkably well and the herd has increased from the original ten imported heifers and two bulls to a total of twenty-four, there being now eight young bulls and bull calves and four heifer calves.

Foot and mouth disease restrictions have debarred the sale of breeding stock for the last nine months and in consequence there is an abnormally heavy carry-over of young bulls. For similar reasons only a few pedigree pigs could be sold.

Experiment and Demonstration Stations.—Operations on the Bulawayo Demonstration Station, in co-operation with the Municipality of Bulawayo, were discontinued at the close of last harvest, the crop experimental work for Matabeleland being now centred at the Matopo School of Agriculture. The Department is greatly indebted to the Municipal Council of Bulawayo for the readiness with which they met the writer's original request in 1921 for assistance in inaugurating this station, and for their continued support of the scheme over a period of ten years. The experiments have afforded reliable information on many important problems connected with arable farming in Matabeleland.

On the closing down in July of general crop experiments on the Tobacco Experiment Station, a report summarising the results to that date was prepared by Mr. C. Kelsey-Harvey—the then manager—and was published in the *Journal.*

Reports have likewise been published in the *Journal* on the results of all major investigations in progress on the Agricultural Experiment Station, Salisbury, and on the Gwelo Demonstration Station, and further comment here is unnecessary.

Good progress is being made on the Enkeldoorn Demonstration Station situated on Belvoir Spinney and the yields during the past two seasons on this poor granite sand have been highly satisfactory. Maize returns in the various rotations have ranged between 6¾ and 14 bags an acre, the

latter being obtained last season from maize receiving 200 lbs. of 19 per cent. superphosphate per acre, following sunn hemp ploughed under.

An interim report on the first four years' results will be published after next harvest.

Wet Maize.—It is gratifying to record that the campaign of the last few years against wet maize has at last borne fruit, and very little trouble from this cause was experienced, save in one area which had not previously participated in export overseas. Here, however, growers had evidently been in the habit of marketing their maize for local consumption in a very moist condition, and the bulk of the grain first forwarded to the local Co-operative Society was too wet to export. A special visit was paid to the area by the Senior Grain Inspector and the writer to enquire into the matter and explain to growers the causes to which wet grain is usually attributable.

The marked improvement in this respect throughout the rest of the maize belt is undoubtedly mainly due to the summarised reports which were published in the *Journal* and local Press on the improved harvesting methods adopted by growers who have consistently managed to overcome this difficulty.

Maize Grading.—There was not as large a falling-off in the amount of maize requiring to be graded as was expected. In all, 663,223 bags of maize, 20,084 bags of meal and 2,564 bags of sunflower seed were inspected and graded. Of the maize and meal, 36,383 bags were graded by checkers of the Maize Control Board and the remainder by Government graders.

The figures for the past three years are as follows:—

1929	908,139 bags of produce graded.
1930	870,238 bags of produce graded.
1931	685,871 bags of produce graded.

Demands for grading along the main railway line as distinct from the branch lines is increasing, and this year 85,500 bags of maize were graded between Gatooma and Inyazura. This maize mostly offers in small parcels at widely separated points and much travelling is entailed by its inspection.

Two grain inspectors were employed for 9½ months of the year, aided by three temporary graders—one for 2½ months and two for one month each.

Yellow Maize.—A case occurred where certain persons planted yellow varieties of maize in close proximity to large extents of white maize, in a locality not proclaimed under the Maize Act of 1925 as a white maize area. Serious injury would have resulted to the neighbouring growers of white varieties had those who planted yellow strains not agreed to the crops being uprooted and to a white variety being planted instead. The instance exemplifies the need for growers of white maize to safeguard their position by securing the declaration of their districts as white maize areas under the Act.

International Exhibition, Elizabethville.—In collaboration with Northern Rhodesia and the Rhodesia Railways, a Rhodesia Pavilion was erected at this Exhibition and a joint exhibit was staged. The arrangements were left to a committee representing the three administrations, the Chief, Division of Plant Industry, acting for Southern Rhodesia, and attending the Exhibition for the first week. Exhibits from this Colony were mainly confined to raw and manufactured agricultural products likely to find a market in the Congo. Local commercial firms lent ready support to the scheme and the material forwarded was of very high quality and thoroughly representative of the agricultural industry.

Acknowledgments.—In conclusion, it is desired to record with appreciation the loyal and efficient manner in which all members of the Division have carried out their duties. Our sincere thanks are offered to other sections of the Agricultural and Veterinary Departments, to the staffs of other Government Departments, and to all organised bodies and private individuals upon whose co-operation and good will such frequent calls are made.

MYCOLOGICAL NOTES.

DIPLODIA IN MAIZE.—THE BENEFITS OF SEED TREATMENT.

By J. C. F. Hopkins, B.Sc., A.I.C.T.A., Plant Pathologist.

At this time of the year, when crops are being harvested, the question of Diplodia and its control becomes once more a matter for discussion amongst the maize growers, for the destruction of crops caused by the parasite is at once obvious and alarming. The question is then asked: "Cannot something be done to prevent these losses?" And the answer is again heard, as from a voice crying in the wilderness: "Yes; clean up your maize lands as early as you can and burn off the superfluous trash." Ploughing in stubble does not eradicate Diplodia, and infection is carried to next year's crop, when a further destruction of cobs becomes inevitable.

Losses from Diplodia are not, however, confined to straightforward rotting of grain; in fact, it is the more obscure phases of the disease which are responsible for the largest reductions in yield. A "mouldy" cob obviously gives a high proportion of infected grain, and is rejected when selecting seed, but a cob which has a few brown kernels and is otherwise apparently sound is retained. Generally speaking, this policy is adopted by most growers, so that it is extremely difficult, if not impossible, to find in the Colony a commercial sample of seed which is not infected by Diplodia. Most samples which have been tested in the Plant Pathology Laboratory have yielded between 20 and 30 per cent. of diseased kernels; some up to 55 per cent. When such seeds are planted, a good number fail to grow owing to the germ having been killed by Diplodia.

Others which do germinate are forced to struggle for existence against the attack of the parasite, and frequently

succumb before they have developed a sufficient number of roots to maintain themselves. This "seedling blight," as it is called, is commonly responsible for reductions in stand of 15 or 20 per cent., and occasionally of as much as 40 per cent. under local conditions.

But the effects of Diplodia do not end here. A number of plants which manage to grow to maturity appear never to recover from the check received early in the season, either because their root development is impeded by fungus activity, or else because they become crowded out by their more vigorous neighbours. These plants usually produce small cobs or nubbins, and do not "pull their weight" in the crop. They are not a paying proposition, or, as the Americans say, they are unprofitable boarders.

How, then, is a crop to be freed from such plants? Obviously, by selection of healthy seed and by the use of a fungus poison capable of killing Diplodia; in other words, seed treatment by a suitable fungicidal dust such as Tillantin R, Semesan Junior, Merko, or other of the many commercial products upon the market. Consistently good results have been obtained locally with seed treatment; and even with seed selected kernel by kernel, an increase in yield of as much as 4 per cent. has been obtained by the use of a Tillantin R dressing.

Confirmation of the benefits to be derived from seed treatment with modern fungicidal dusts may be found in a recently published bulletin of the United States Department of Agriculture (1), which gives the results of eleven years' investigation into the value of maize seed disinfectants. The conclusions arrived at by the authors are as follows:—

At the beginning of the eleven-year period, liquid treatments were more effective than the dust disinfectants then available, but at the present time dust disinfectants have entirely replaced the liquid treatments. Suitable maize seed dust disinfectants are effective in controlling such infections of Diplodia as occur in well-selected lots of seed, and also aid in controlling other seed-borne diseases (*which are included under the name of Diplodia in Rhodesia.—J. C. F. H.*), and offer some protection against soil-borne diseases.

The use of seed treatments is usually followed by better stands and increased vigour in the young plants, which is occasionally reflected in a greater resistance to lodging. Ear rots were found to be slightly reduced by the use of seed treatments (*no such evidence has been obtained in Rhodesia.*—J. C. F. H.), and the yield of maize grown from average, well-selected farmer's seed was found to be increased by about a bag an acre. This would mean, under Rhodesian conditions, a return of between 6s. and 7s. per acre for the expenditure of about 2d. per acre.

The authors conclude the report of their eleven years' study with the following paragraph: "*It appears that seed treatment may be considered and used as an effective means of guarding against such losses as result from seed-borne infections and soil-borne diseases that adversely affect corn* (*i.e.*, maize) *plants during the young plant stage.*"

It is to be hoped that a spirit of false economy will not cause our maize growers to be imbued with the fallacy that the discontinuance of seed treatment is a way of cutting down overhead expenses; for an increase in yield of only one bag per acre represents an addition of 10 per cent. to the annual income, and can be obtained for the outlay of a few pence per acre.

REFERENCE.

(1) Holbert, J. R., and Koehler, B.—"Results of Seed Treatment Experiments with Yellow Dent Corn." *U.S. Dept. Agric., Tech. Bull.* 260, December, 1931.

NOTES ON THE PRODUCTION OF ESSENTIAL OILS,

WITH SPECIAL REFERENCE TO RHODESIA.

By LIEUT.-COLONEL STEWART GORE BROWNE, D.S.O.,
Shiwa Ngandu, Mpika, Northern Rhodesia.

The present writer has been asked so often about the possibilities of producing essential oils in Rhodesia that the following notes on the subject, which are the result of over ten years' experience with essential oils in this country, may not be without general interest. It is to be feared, however, that most of the information is of a negative character.

In the first place, it must be emphasised that it is quite useless to think of starting to manufacture essential oils without a considerable amount of capital, for the following reasons:—

(1) The distilling plant is costly, and it is required in addition to most of the agricultural gear used on an ordinary farm.

(2) A big acreage has to be kept under cultivation, and abundant labour is needed. The crops are bulky, though the yield of oil is small.

[The low yield affects the cost of production materially, and is one of the reasons for the comparatively high price of most essential oils. Thus a ton of orange blossom will only produce about 40 ounces of neroli oil. An acre of geranium, containing from 10,000 to 15,000 plants, which can be cut two or three times a year, will not yield more than about 20 lbs. of oil annually (worth at present prices about £16). Lemon grass, with an oil percentage of 0.2 to 0.4, should yield about 30 lbs. of oil per year (worth, perhaps, £4) per acre.]

(3) The market is a highly speculative one. Thus peppermint oil, which touched £6 per lb. in 1925, is to-day worth 7s. 6d. On the other hand, distilled lime oil, which was worth 2s. 3d. per lb. in 1923, is to-day quoted at 42s. 6d. per lb.

It follows, therefore, that to go in for essential oils as a side-show whilst hoping for better times in ordinary farming, or whilst waiting for other crops to mature, is not a practical proposition. Nor are essential oils money for nothing in any sense of the phrase, and they certainly do not meet the case of one correspondent who complained that his own branch of farming had become an all-the-year-round job, and he wanted something less exacting.

There are some fifty to sixty different kinds of essential oils which are normally quoted in the market, besides many others of purely theoretical interest. The market oils fall roughly into two classes—those which are of use to the soap-makers and those which are used for a variety of special purposes, such as medicine, perfumery, chemistry, etc. Oils in the former class are required by the ton, but their price is, comparatively speaking, low. Oils in the latter class are only used in small quantities and the demand is irregular, though the price is often high.

Of the oils in steady demand, some are from plants which will only grow in tropical countries and some only in temperate climates. Cloves are an instance of the former, and lavender and caraway of the latter. Others will not yield to simple distillation and need not be considered here.

The following, however, which are all oils in constant demand, can be distilled from plants or trees which do well in Rhodesia, and are worth considering as a commercial proposition in this country:—

Oil.	Price Range, 1921-31.	Oil Percentage.
Geranium	10/- to 40/6 lb.	0.2
Peppermint	7/3 to 120/6 lb.	0.15
Lemon Grass	1/8 to 4/8 lb.	0.2 to 0.4
Citronella	1/4 to 6/3 lb.	0.4
Oil of Limes (distilled)	2/3 to 45/- lb.	0.2
Neroli	15/- to 150/- oz.	0.1
Petitgrain	4/2 to 22/6 lb.	0.15 to 0.3
Eucalyptus	1/3 to 3/- lb.	1.0

The plants from which these oils are obtained have all been grown by the present writer at Shiwa Ngandu, in Northern Rhodesia, with the exception of citronella, which, however, corresponds closely in all respects with lemon grass, under the following local conditions:—

Altitude: 5,000 feet to 4,500 feet.

Annual Rainfall: 44.43 inches (normal).

Temperature Range: 85 degrees to 31 degrees (approx.).

Soil: Generally light, sandy.

Fertilisers Available: Kraal manure, wood ash, distillation residue.

The general conclusions arrived at so far are that there is no difficulty in raising these oil-bearing plants, and a good many others besides, on a small scale; nor is there any great difficulty about distillation, and the results obtained in practically every case have been, according to the laboratory analyses at home, oils above the average in quality. The percentage of oil obtained seems to be about the same as in other countries; in the case of eucalyptus oil it has been consistently above the normal. The chemical constituents of the oils are also normal. The real difficulty seems to lie in establishing these crops on a large enough scale to enable the costs of production to be kept low enough to make the manufacture of the oils a commercial proposition.

The following cultural notes may be of interest. Costs are not given, partly because so much of the work has been experimental, partly because the price of labour varies so in different parts of the country that they might only be misleading.

Geranium.—Distilled from the leaves and stems of *Pelargonium roseum* and *P. odoratissimum* and various hybrids. The plants grown here came originally from cuttings from Corsica, but the main centres of the industry are the South of France, Algiers and Réunion. Cuttings are the only means of propagation and are not difficult to strike, but there is apt to be considerable loss in planting out. I did not find planting cuttings in the open field *in situ* satisfactory, however. Cuttings should be twelve inches to fifteen inches long, and any time in the warm weather before the

rains seems a suitable time to strike them. A light, well drained soil is the best for growing geranium, and anything approaching a water-logged site is fatal. Plants should be set out about eighteen inches apart. Cultivation is very important and has to be done by hand. Here the whole area had to be hand cultivated at least three times during the wet season. Reaping also has to be done by hand with knives or secateurs. Three cuts a year are said to be obtained in Algeria, but I have never got more than two here. A plantation should last up to ten years, but here white ants and the excessive damp of the rainy season kill off the majority of the plants after the first year. The oil distilled here was exceptionally well reported on and sold readily in London, but the short life of the plants and the cost of production did not leave any margin of profit. It would seem, however, that this crop would be well worth investigating in localities with a lower rainfall, where too the menace of weeds and white ants might not be so great.

Lemon Grass.—This is a low priced oil distilled from the leaves of *Cymbopogon flexuosus* or *citratus*. The plants are propagated by division of roots, and it is a very easy crop to establish. It prefers light, well drained soil, and if the plants are set out at about twelve inches by eighteen inches at the beginning of the rains, one cutting can be obtained by the following March. When the crop is established, three cuttings a year are possible. It has to be replanted at intervals of about four years and is an exhausting crop. There is a large demand for lemon grass oil for soap-making, and the oil produced here sold readily and was described as "a good marketable oil of the West Indian type." But the price is low, and £4 to £5 per acre is the outside value of the crop. It follows, therefore, that the cost of production must be kept down, and unless the grass can be relied on to smother weeds and practically grow itself it will not be profitable.

Citronella Grass (*Cymbopogon nardus*) is the source of citronella oil, for which there is a big demand. It is similar to lemon grass in all respects, except that it does not require replanting every few years. The price of the oil is generally lower than that of lemon grass oil.

Palmarosa (*Cymbopogon martini*, var. *Motia*) and **Ginger Grass** (*Cymbopogon martini*, var. *Sofia*) both yield oils which are quoted at a higher price than either citronella or lemon grass oil, but the demand is small.

All these grasses are grown largely in Ceylon, the West Indies and India. A grass similar to lemon grass is indigenous in Northern Rhodesia in the Luangwa Valley.

Peppermint Oil.—This is an oil in considerable demand, and large quantities are produced annually in the U.S.A. and in Japan—in the former country from *Mentha piperita*, in the latter from *Mentha arvensis*. There was a boom in 1925, and for a short time the price rose as high as £6 per lb., but 7s. 6d. is about its normal value. The plants grow easily from suckers, but in this country I found that they died down after a year instead of lasting four or five years as they should. Rich peaty soil is the best, and the yield of oil from an acre should be twenty to thirty pounds.

Citrus Oils.—From the flowers of the bitter orange (*Citrus bigaradia*) neroli oil is distilled, and from its leaves petitgrain oil. The juice of limes (*Citrus medica*) when distilled yields oil of limes or limette, and the rind of limes, when hand-pressed over spikes, also yields a valuable oil. Oil of bergamot is expressed from the rind of *Citrus bergamium*, and oil of lemon from the fresh peel of lemons (*Citrus medica limonum*). All these oils are in considerable demand and command good prices, though lemon oil is in danger of being over produced in Sicily, and the high price of lime oil is quite abnormal and due to hurricanes in the West Indies having destroyed the plantations there.

As most varieties of citrus thrive in Rhodesia, it would seem as though there were a considerable opening for the production of these oils, but it must be remembered that it takes at least sixty trees in full bearing to produce a pound of neroli oil, one hundred gallons of lime juice to give four pounds of distilled lime oil, and fifteen hundred lemons to yield a pound of lemon oil. Consequently, most owners of citrus orchards are likely to prefer to stick to growing and selling fruit. In any case, as the method of growing trees for oil is the same as that for growing them for fruit, there is no need to say more here.

Eucalyptus Oil.—The ordinary eucalyptus oil of commerce is distilled from blue gum, which every Rhodesian farmer knows how to grow. Unfortunately the price of the oil is very low and there are ample supplies of it.

The present writer spent a great deal of time and energy establishing plantations of *Eucalyptus citriodora*—not an easy tree to handle in its early stages. The oil, however, is difficult to dispose of, and for some reason or other that distilled here seems to be inferior in quality to the Australian oil.

Miscellaneous Oils.—Spearmint, tansy, coriander and fennel were also experimented with here. The quality of the oils distilled was well reported on, except in the case of the last-named; but the demand for them is small, and there would be no object in growing them except in small quantities to fill up a larger consignment of more marketable oils.

Various local grasses and herbs have also been distilled, but nothing of commercial value has yet been discovered.

Distillation.—It remains to indicate briefly what is involved in the manufacture of the oils after the crop has been reaped.

The process of distillation is a simple one and does not require an elaborate plant. The latter consists of (1) a container or alembic, in which the material to be distilled is boiled with a certain quantity of water, (2) a swan-neck, which carries the resulting vapour from the alembic to (3) a condenser coil, round which cold water circulates, causing the vapour to condense to liquid.

The liquid consists partly of water and partly of oil; the latter floats on the top of the water and can easily be separated from it.

The boiling up of the material to be distilled can be either by means of an open fire under the alembic (a method which is now nearly obsolete, owing to the risk of damaging the oil by excessive heat) or by passing steam through the alembic, either direct or through a closed coil lying in the water; therefore (4) a steam generator is also a necessary part

of the plant. As, however, the steam is only required at a pressure of a few lbs., any simple form of boiler is adequate.

A certain amount of practice is necessary in regulating the temperature and knowing when to stop distilling. Sufficient mechanical skill to keep the various joints steam-tight is required, and reasonable care must be exercised in collecting and filtering the oil. But that is all. It is not the case, as stated in a South African technical journal, that "an ordinary native is quite capable of taking charge of the process," but at the same time it is not necessary to retain the services of a professional engineer.

It is difficult to give an accurate idea of the cost of the plant. It would, of course, be possible to distil with a home-made installation consisting of some forty-four-gallon petrol drums, with three-inch piping cooled in a running stream as a condenser. The first still used here cost £50 in Paris, and was quite adequate for experimental work. But for serious work on a commercial scale, handling the produce of, say, four hundred to five hundred acres, the installation would have to consist of at least eight to ten eight-hundred-gallon stills, and the cost could hardly be less than £1,500 to £2,000.

Conclusion.—From the above it will be seen that, to repeat what was said at the beginning of these notes, essential oil production is neither suitable for a stop-gap on a small farm nor for a side-show on a big estate. At the same time, there are various considerations which would make the manufacture of these oils, or some of them, an attractive proposition under certain circumstances in this country. The comparatively high value of the oils in proportion to their bulk is a great recommendation for those of us who have heavy freight charges to consider. Labour, wood fuel and water—all of them necessary factors in the production of these oils—are still cheap and plentiful in most parts of Rhodesia. And finally, there is a considerable fascination in attempting something out of the ordinary run of local crops—provided it can be made to pay.

Possibly the best way to produce essential oils profitably would be for a group of farmers to work in co-operation,

keeping down overhead charges by running a common distillery in which one of their number would specialise, and a common organisation for the marketing of their produce, whilst individual members of the group concentrated on various different crops so as to be as far as possible independent of market fluctuations which may be fatal to the success of any one single crop.

REPORT OF THE SENIOR ANIMAL HUSBANDRY OFFICER

FOR THE YEAR ENDED 31st DECEMBER, 1931.

By A. E. Romyn, Ph.D.

The cattle industry has been more or less at a standstill this year, owing to the outbreak of foot and mouth disease. The year gave promise of being a good one, and the outbreak of this disease was, therefore, particularly unfortunate.

1. Beef Production.—(a) *General.*—The effect of the restrictions on the export of cattle to adjoining territories has brought home to farmers the urgency for developing an overseas trade in chilled or frozen beef. Avenues of export have been explored in all directions, but so far nothing tangible has resulted. Investigations are proceeding.

Unfortunately, the great bulk of cattle available for export is only suitable for the frozen meat trade. This trade at present price levels is generally unremunerative, and the demand for frozen beef is decreasing. The number of cattle in the Colony suitable for the more remunerative chilled meat market is insufficient to produce workable quantities for export, and the prospect of low prices for most of the meat exported has so far discouraged export. Under the present

circumstances, however, producers are willing to develop any trade which shows promise of a subsistence return.

With the relatively low values ruling for land, this Colony is in a strong position to develop an export trade in animal products. The first essential is to raise the quality of the existing beef herds. This must take time; but there are no insuperable difficulties in the path of progress, provided producers will organise themselves and take reasonable measures to improve the quality of their cattle. Translated into practice, this means that cattle farmers must use better bulls, follow a system of proper veld management and make some provision for winter feed.

(b) *Export of Cattle on the Hoof.*—In January arrangements were concluded to send two consignments of bullocks, totalling nine hundred head, on hoof to England. The outbreak of foot and mouth disease occurred when the first consignment was on the water. The second consignment had to be cancelled, but permission was obtained to land the first shipment *ex* S.S. Clan Morrison at Cardiff instead of at the original destination of Birkenhead.

For our purpose the marketing facilities at Cardiff are not as satisfactory as at Birkenhead, and most of the cattle had to be sold at Smithfield, which is not a good market for the heavy type of bullock forming the majority of the consignment. Prices were unsatisfactory, and in most cases the nett returns plus the bounty did not amount to the store value of the bullocks. An extra charge of 11s. 3d. per head was incurred in diverting the ship to Cardiff. Excluding this charge, the total transport costs to the United Kingdom amounted to £1 3s. 11d. less per head than those on the previous shipment per S.S. Clan Malcolm. The second consignment was cancelled at a serious loss to many feeders who had purchased store bullocks especially for export.

The export of bullocks on the hoof was generally regarded as a transitional stage to the more stable export trade of chilled meat. A set-back occurring at the present juncture is most unfortunate. A number of new shippers had been persuaded to participate in these shipments, and the reverse in their case has been very discouraging. In some quarters it is felt that the set-back is final, but it is hoped that when conditions improve it will be possible and profitable to revive the trade.

(c) *Breeding Cattle.*—During the year there has been relatively little demand for breeding cattle except dairy cows, which have sold at fair prices. The restrictions on the internal movement of cattle have not been altogether a handicap. Under the circumstances, they have served to maintain the price of slaughter cattle, which otherwise would probably have sunk to still lower levels than those existing at present. Generally speaking, breeders of pedigree stock have had a bad year, as most commercial breeders have as far as possible postponed the normal replacement of bulls.

2. Dairying.—The dairy industry continues to expand, and is at present the most encouraging branch of the live stock industry. Owing to measures of stabilisation taken under the "Dairy Control Act, 1931," prices for dairy products have so far been well maintained. A steady expansion of the industry can be anticipated, but producers have yet to realise that considerable improvement in the general methods of production is needed to bring the industry on to a competitive level with dairying countries overseas. Farmers must aim at lower production costs by increasing the output per cow.

The relatively higher value of dairy products when compared with beef has led to the over-milking of cows on many farms where provision has not been made for supplementary feed, and has also led to the spread of dairying into some areas not well suited to the production of cream. This tendency is inevitable under existing economic conditions, and may be expected to adjust itself gradually when the prices of beef and dairy products return to a normal relationship.

The creamery facilities in the Colony continue to improve, and practically all the factories are now equipped to turn out high-grade butter. A very satisfactory development in this field is the establishment of an entirely new creamery in Salisbury, which when completed should prove one of the best equipped in South Africa. A new factory has been opened in Bulawayo, bringing up the total at that centre to five. The Dairy Officer remarks that "this is hardly a matter for congratulation," as there is now a danger of overdoing the number of factories. It is obvious that mass production reduces overhead expenses, and the policy of the

Department in future should be to discourage the establishment of new creameries unless there is some very obvious justification for their erection.

A considerable expansion of the cheese industry is looked for in the near future. Keen competition in this field is likely to arise from adjoining territories, and the Dairy Officer points out that it will be necessary for Rhodesian cheesemakers to improve the quality of the cheese manufactured locally to meet this competition successfully.

The contact between the dairy section and the trade has been closer this year than at any time hitherto, and there is good reason to feel that this closer co-operation will be of benefit to the industry in this Colony.

3. Sheep and Wool.—The year has been a successful one as regards breeding operations. The dry winter season proved favourable to sheep, and especially on the eastern border flocks are now in relatively good condition.

In the earlier part of the year prices for mutton sheep were well maintained, but towards the end of the year importations from the Union resulted in a fall in the price of local sheep. The low value for wool has discouraged the sale of that commodity, and many of the smaller producers have made no attempt so far to sell this season's clip.

On the ground of economy it was found necessary to dispense with the services of Mr. J. C. Kruger, who has done good work as part-time sheep and wool officer in the Melsetter district.

For some years to come it is likely that there will be a profitable market for mutton sheep in the Colony. The eastern border areas offer good possibilities for the development of Merino sheep; but the local farmer as a rule knows very little about sheep management, and it is unlikely that without proper guidance it will be possible for him to take advantage of the opportunities available. For this reason it is unfortunate that it was found necessary to dispense with a sheep officer, and it is hoped that a fresh appointment will be made as soon as conditions improve.

4. Pigs.—The year has not been a profitable one for producers. Varied restrictions on the export of pigs and pig

products from Southern Rhodesia, combined with the free import of bacon from the south into the Colony, have led to a surplus of pigs. The best grade of baconers have been sold on a "rationed" market at 3d. to 3½d. per lb. live weight. There has been no encouragement for production, and little progress has been made by the industry as a whole.

The future of the industry will lie eventually in the export of pig products overseas. This stage has not yet been reached. In the meanwhile, farmers must concentrate on the production of a better type of pig than is turned out at present. In this movement the curer must play his part by proper grading at the factory and the payment of a significantly better price for the best grade of pig. The immediate improvement will be to the benefit of both sides, as a well-bred pig is not only a more efficient producer than the "scrub," but it "cures" more satisfactorily and with less waste. Once producers are able to produce a good pig, the expansion of the industry to allow for export should be relatively rapid.

5. Poultry.—The Poultry Officer reports that on the whole the industry has "marked time" during the year.

The domestic competition between co-operators and non-co-operators in the Rhodesia Egg Circle has tended to depress prices, and it has been difficult to dispose of surplus eggs at payable prices. Complaints have been received as to the quality of eggs obtained from distant suppliers, and it appears that it will be necessary to institute a system of grading in order to give producers of truly fresh eggs the advantage they deserve. The poultry officers are endeavouring to bring about a better state of organisation in the industry. Such organisation appears essential for progress.

6. Investigations.—In a general way the problems confronting the live stock breeder in this Colony can be divided into two groups—(a) markets, (b) how to lower the cost of production of his basic products.

To a certain extent these are closely related.

Many problems await investigation, and it is unfortunate that in a pastoral country such as Southern Rhodesia so little serious investigation in the field of animal feeding and breeding has so far been undertaken. A start has been made

this year with cattle and pigs at the Matopos School of Agriculture, and with poultry at the Poultry Station, Salisbury. The chief investigations are:—

(1) A study of the effect of protein and mineral supplements on the growth of ranch cattle.

(2) A study of the effect of certain local feeds on the quality of bacon.

(3) A broad study of home-grown rations for poultry.

On the marketing side, two investigations which have been completed are;—

(1) An agricultural survey of the proposed Walvis Bay Railway route.

(2) The preservation and shipping qualities of chilled beef under local conditions.

A report on both of these subjects has been presented.

7. Extension Work.—On account of the lack of funds, farm visits and extension work in all branches of the Animal Husbandry section—cattle, dairying, sheep, pigs and poultry—have been much curtailed this year. In some cases it has not been possible to make full use of the services of officers of this section, and it is hoped that it will be possible to provide sufficient funds next year to enlarge essential organising and inspection services in regard to dairying, sheep, pigs and poultry, which have been reduced this year.

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

SPEAR GRASS.

(*HETEROPOGON CONTORTUS*, R. & S.).

By J. M. Rattray, M.Sc., Botanist.

Introduction.—Now that the importance of improving the natural pastures of this country is being realised, it is obviously advisable to become better acquainted with some of the main species of grasses occurring in the pastures. The following article deals with one of the commonest grasses in Rhodesia, and is an attempt to show what importance economically should be attached to it.

Description.—*Heteropogon contortus*, R. & S., belongs to the same section of grasses as the Rhodesian blue grass (*Andropogon gayanus*) and the Tambookie grasses (*Hyparrhenia* spp.), viz., the *Andropogoneæ*. In the Union it is known as "spear grass," and in Rhodesia it is commonly called "assegai grass," though the name "spear grass" is also extensively used. In India it has the very appropriate common name of "twisted beard grass."

It is an erect tufted perennial with very compressed leaf sheaths and light green leaves up to 9in.-10in. long and about ¼in. wide. The flower head is a "spike" with the spikelets tightly compacted together and bearing long twisted awns. The "seed" is extremely sharp pointed at one end and bears the awn, which in the presence of moisture coils up and produces a boring movement. When the seed plus awn falls to the ground the first shower of rain causes the awn to coil up and in this way the seed is pushed into the soil. A small tuft of stiff hairs behind the point of the seed allows it to be pushed in, but prevents it from coming out again.

Thus it is that Spear grass can establish itself on hard soils, while the seeds from other grasses are blown or

washed away before they can germinate. Dew and sunshine cause the awn to twist and untwist and so drive the barb into whatever it is in contact with.

It is this property which the seed possesses of being able to bore its way in, that makes Spear grass the curse that it is on certain grass lands.

Fig. 1.
Heteropogon contortus, R. & S., Spear Grass.

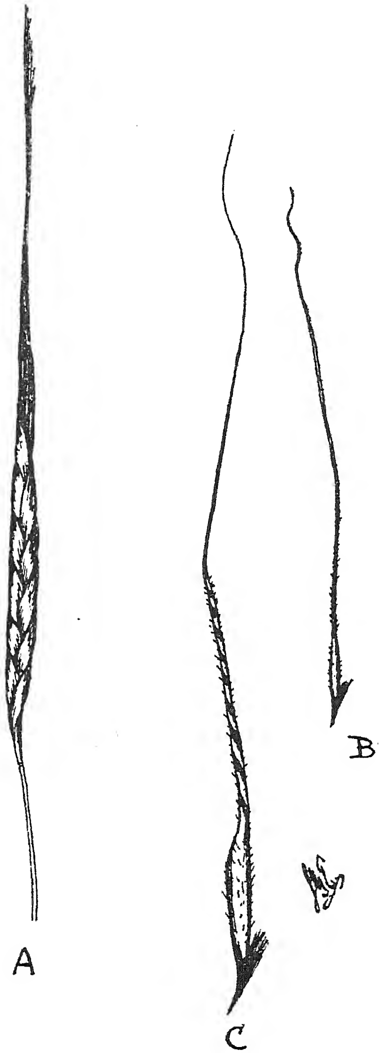


Fig. 2.

A. Flower Head of Spear Grass.

B. "Seed" of Spear Grass bearing the awn.

C. Enlarged View of B, showing sharp-pointed seed and twisted awn.

Distribution.—This species of grass is widespread over the tropical, sub-tropical and warm temperature regions of the world, including the Mediterranean region. In Rhodesia it has been collected in the Matobo, Bulawayo, Nyamandhlovu, Victoria Falls, Bubi, Salisbury, Hartley, Marandellas, Makoni, Inyanga and Umtali districts.

Economic Importance.—*Value.*—Hitchcock states that in America it "is an important forage grass," and in the Hawaiian Islands, where the natives use it for thatching, it is also a useful forage grass. In India if cultivated and cut before ripe it is considered one of the most nutritious grasses in that country. In the Union it is spoken of as yielding good grazing while young, but is a grass to be discouraged on account of the sharp-pointed seeds which injure stock.

In Rhodesia, Spear grass is generally looked upon as a weed of little or no value in pastures, except probably when very young.

Injurious Properties.—But if stock, especially sheep, are to be run on the poorer grass lands of this country with any measure of success, then one of the most important factors to be considered is the presence of Spear grass in the pasture. The species is very abundant on many of the poorer types of soil in the Colony and the "seed" which it so prolifically produces is most injurious to stock on account of the boring properties already described. When the hide of an animal is pierced and the seed has entered the flesh, inflammation usually sets in and sores are developed, which greatly detract from the value of the hide. But it is not only the hide of the animal which is in danger of being ruined; it is obvious that when an animal is badly invaded by the seeds, its condition will go down, and, in the case of sheep, wool production will be lessened, and what wool is obtained will be so matted with the awns as to be almost valueless. The seeds have even been known to cause the death of sheep.

Control Methods.—As Spear grass flushes very early in the season and is fairly palatable when young, it may be unwise to attempt to eradicate the whole plant, more so as

it often happens to be the dominant grass in a pasture. A more feasible plan is to prevent the grass, as far as possible, from seeding. Mowing the pastures before the seed has set would fulfil this condition, but this would only be practicable when the pastures are stumped and are of a fairly limited acreage.

A further difficulty which may be encountered in connection with mowing as a method of control was observed on land at Marandellas. When the flower heads of Spear grass first appeared they were quite erect and stood vertical to the ground, but as they grew older they leaned to one side to allow the new flower heads to come up from the centre of the crown. This went on for some time owing to the prolific way in which Spear grass flowered, so that when mowing commenced the old mature flowers were almost parallel to the ground and the general appearance of the plant, from the side, was fan shaped. The mower came over the plant, cut off the central erect younger flower heads, but left the mature ones round the outside of the crown, so that there was still an abundance of seed available to the plant for dissemination.

One might think that fairly heavy grazing would tend to keep down Spear grass, but it seems to be the general consensus of opinion that over-grazing causes it to increase. And in any case, too, heavy grazing should be avoided as far as possible, as it is likely to prove injurious to the other constituents of the pastures.

It has been said that Spear grass appears to be palatable when young. Unfortunately it seems either to lose this palatability as it grows older, or it is not as palatable as the surrounding grasses even at the time of flushing, because as soon as new growth is visible in the other grasses, stock leave the Spear grass severely alone in favour of other species. In this way it rapidly reaches maturity and produces its seed in great abundance.

Chemical Analysis.—An analysis of an air-dried sample of Spear grass, cut on the 4th March, 1932, when it was in full flower, showed it to have a low feeding value—the nutritive ratio being 1: 20.

The following are the results of the analysis:—

	%
Moisture	11.2
Ash	4.9
Crude Protein	3.9
Ether Extract	1.5
Fibre	36.0
Carbohydrates	42.5
	100.0

As this sample was cut late in the season, it is only to be expected that the protein content would be low and the fibre fairly high, so that the merits of the grass should not be judged on this analysis alone. It is hoped later to obtain other analyses of the grass cut at different periods of the season. Only when this is done can any conclusion be drawn as to its nutritive value.

Acknowledgment is made to the Division of Chemistry for the above analysis.

Conclusion.—The animal is the best judge of the palatability of any grass, and from observations made, it appears as though it is only in the very young stages that Spear grass is at all relished. Since it possesses such harmful properties when old, it must be considered an undesirable, even detrimental, constituent of a pasture.

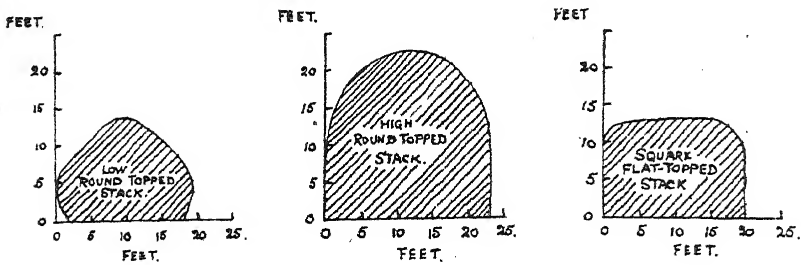
MEASURING STACKS OF HAY.

The United States Department of Agriculture, in conjunction with certain of the State experiment stations, recently had occasion to question whether the old formulas used in estimating the contents of hay stacks were accurate or otherwise.

On a careful study of the subject being undertaken, it was found that calculations based on the previously used rules were generally inaccurate, and investigations were then undertaken with the purpose of developing a new rule or rules, which, while using the old measurements, would give more accurate returns.

The results of this investigation were published by W. H. Hosterman, of the Bureau of Agricultural Economics, in Leaflet No. 72 of the United States Department of Agriculture, from which the following extracts are taken:—

"The width and over measurements are made easily, and for this reason those who buy and sell hay by measure use rules that require only three measurements, namely, width, length and over. Width is the width of the stack at the ground; length is the average length of the stack; and over is the distance from the ground on one side over the stack to the ground on the other side.



Cross sections of typical oblong stacks.
(Leaflet 72, U.S. Dept. of Agric.).

"The volumes determined by these rules averaged the same as the actual volumes of the stacks, and in no case was the error over 5 per cent.

"The three types of stacks illustrated, with the rule for each type, are as follows:—

For low, round-topped stacks, (0.52 x O)−(0.44 x W) x WL
For high, round-topped stacks, (0.52 x O)−(0.46 x W) x WL
For square, flat-topped stacks, (0.56 x O)−(0.55 x W) x WL

"In these rules O equals the over, W equals the width and L equals the length.

"Example.

"To determine the volume of a rectangular stack of the high, round-topped type, that is 20 feet wide, 45 feet over and 50 feet long:—

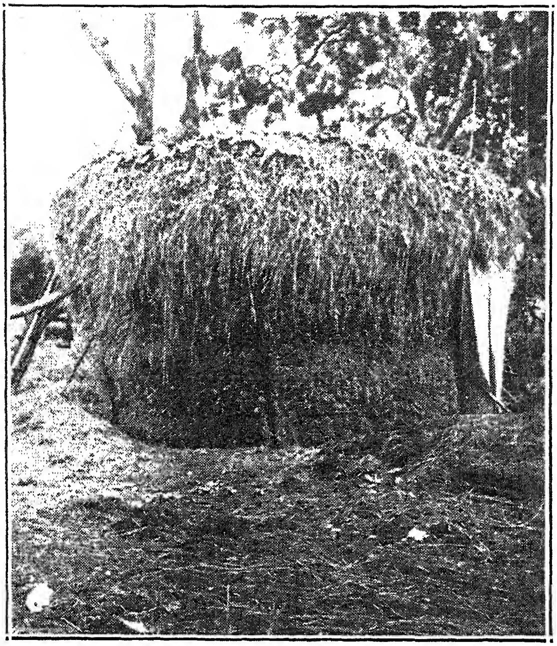
Volume = (0.52 x 45)−(0.46 x 20) x (20 x 50)

45	20	50
0.52	0.46	20
90	9.20	1,000
225		
23.40		
−9.20		
14.20		
1,000		

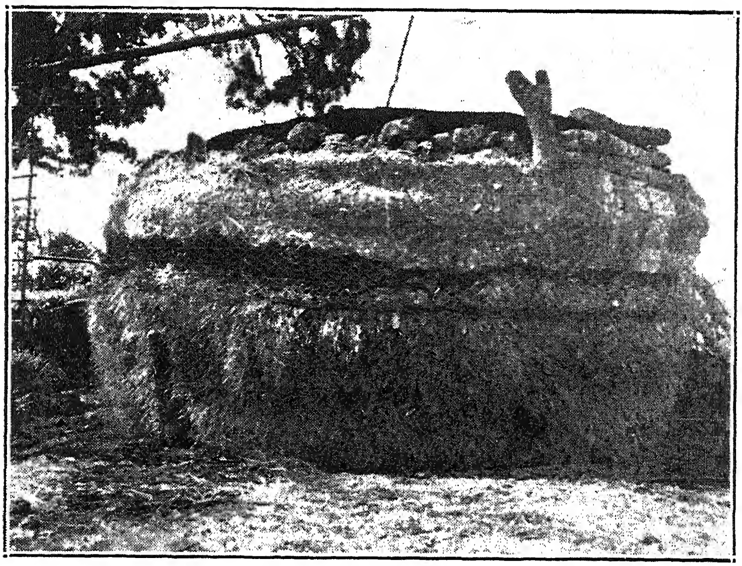
14,200.00 cubic feet in the stack.

"A simple rule or formula, similar to the ones given for oblong stacks, could not be developed for round stacks, but Table I. gives the volume of round stacks when the circumference is between 45 and 90 feet and the over between 25 and 37 feet.

"The volume of stacks having circumferences of overs greater or less than those given in Table I. can be calculated by using the formula: Volume=(0.04 x 0)−(0.012 x C)C². In this formula C equals the circumference or distance around the stack at the ground and 0 equals the over or distance from the ground on one side over the peak to the ground on

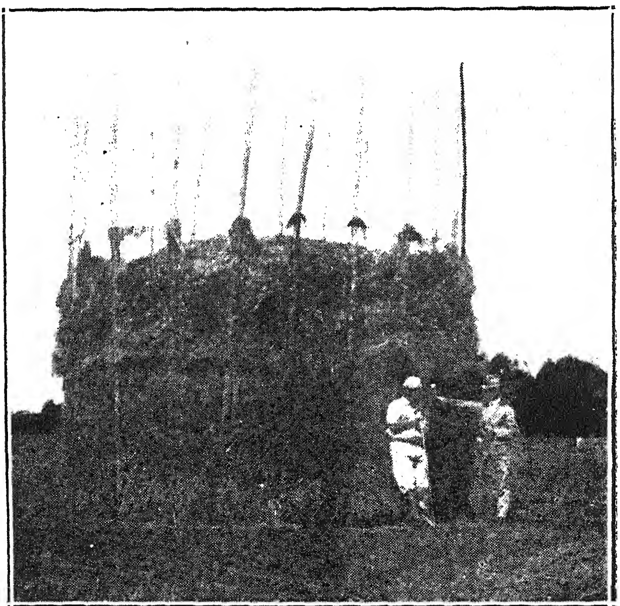


1. Grass silage on the Salisbury Experiment Station: well pulled at base and with sheet suspended to give protection from prevailing wind.



2. The same stack as shown in illustration No. 1, but completed. The top surrounded with an edging of heavy wire netting and the stack weighted within this with stones and logs, the top covered with earth.

3. A grass silage stack weighted down with wires across the top to which bags filled with earth are suspended. The stack is on too large a base compared with its height and the weight applied is probably insufficient. Considerable waste is expected.



4. A completed grass silage stack at the Gwebi farm, built within a circle of gum poles. This system has not given as good results as were expected.

the other side. Usually it is advisable to take two over measurements at right angles to each other and to average them.

"Example.

"To determine the volume of a round stack that is 100 feet in circumference and has an average over of 60 feet:—

Volume = $(0.04 \times 60) - (0.012 \times 100) \times (100)^2$

60	100	100
0.04	0.012	100
2.40	200	10,000
−1.20	100	
1.20	1,200	
10,000		

12,000.00 cubic feet in the round stack.

"Volumes given in the table or determined from the formula will, on the average, amount to the actual volume of the stacks, and in most individual cases the volume will not vary more than 10 per cent. from the actual volume.

"Cubic Feet per Ton.

"Many factors affect the density of hay in the stack, and therefore the number of cubic feet required for a ton of hay. The factor that causes the greatest variation is probably moisture in the hay at stacking time. Tough or slightly under-cured hay will settle and become more compact than very dry or over-cured hay. Other factors like texture and foreign material may affect the density also, but probably not to the same extent as moisture. For these reasons there is often a considerable difference in the number of cubic feet required for a ton in different stacks, and, at present, there are no simple methods for measuring variations in density.

"The following figures, which are the averages obtained from a large number of stacks, can be used with fairly good results:—

"Wild hay: 30 to 90 days in stack, 600 cubic feet per ton; over 90 days in stack, 450 cubic feet per ton."

TABLE I.—Volume of Round Stacks of Hay of Specified Dimensions.

(Volume figures given to the nearest 5)

Indicated volume in cubic feet when the over is—

Circumference	25 feet	26 feet	27 feet	28 feet	29 feet	30 feet	31 feet	32 feet	33 feet	34 feet	35 feet	36 feet	37 feet
45	825	960	1,090	—	—	—	—	—	—	—	—	—	—
46	840	975	1,105	1,235	—	—	—	—	—	—	—	—	—
47	855	990	1,120	1,250	1,385	1,505	—	—	—	—	—	—	—
48	870	1,005	1,135	1,265	1,400	1,525	1,650	1,785	—	—	—	—	—
49	885	1,020	1,150	1,285	1,420	1,540	1,670	1,805	1,935	—	—	—	—
50	900	1,035	1,165	1,300	1,435	1,560	1,690	1,825	1,955	2,090	2,215	—	—
51	915	1,050	1,180	1,315	1,450	1,580	1,710	1,845	1,980	2,110	2,240	2,370	2,495
52	930	1,065	1,200	1,330	1,465	1,600	1,730	1,865	2,000	2,130	2,265	2,400	2,530
53	945	1,080	1,215	1,345	1,485	1,615	1,750	1,880	2,020	2,155	2,290	2,430	2,560
54	960	1,095	1,230	1,360	1,500	1,630	1,770	1,900	2,040	2,180	2,320	2,460	2,595
55	975	1,110	1,245	1,380	1,515	1,650	1,790	1,920	2,065	2,205	2,345	2,490	2,630
56	990	1,125	1,260	1,395	1,530	1,665	1,810	1,940	2,085	2,230	2,375	2,520	2,660
57	1,005	1,140	1,275	1,410	1,550	1,685	1,830	1,960	2,105	2,250	2,400	2,545	2,695
58	1,020	1,155	1,290	1,435	1,565	1,705	1,850	1,980	2,125	2,275	2,425	2,575	2,725
59	1,035	1,170	1,310	1,450	1,580	1,720	1,865	2,000	2,150	2,300	2,455	2,605	2,755
60	1,050	1,185	1,325	1,465	1,600	1,740	1,885	2,020	2,170	2,325	2,480	2,635	2,790
61	1,065	1,200	1,340	1,485	1,615	1,760	1,905	2,040	2,195	2,345	2,510	2,665	2,825
62	1,080	1,215	1,355	1,500	1,635	1,775	1,925	2,060	2,215	2,365	2,535	2,695	2,855
63	1,095	1,230	1,370	1,515	1,655	1,795	1,945	2,080	2,235	2,390	2,560	2,725	2,890
64	1,110	1,245	1,385	1,530	1,670	1,810	1,960	2,100	2,260	2,415	2,585	2,755	2,920
65	1,125	1,260	1,400	1,545	1,785	1,830	1,980	2,120	2,280	2,440	2,615	2,780	2,950
66	1,140	1,275	1,420	1,560	1,705	1,850	2,000	2,140	2,300	2,465	2,640	2,810	2,985
67	1,155	1,290	1,435	1,575	1,720	1,865	2,020	2,160	2,325	2,485	2,665	2,840	3,015
68	1,170	1,305	1,450	1,595	1,740	1,885	2,040	2,180	2,345	2,510	2,690	2,870	3,050
69	1,185	1,320	1,465	1,610	1,755	1,905	2,055	2,200	2,365	2,530	2,715	2,900	3,080
70	1,200	1,335	1,480	1,625	1,770	1,925	2,075	2,220	2,385	2,555	2,745	2,930	3,115
71	1,215	1,350	1,495	1,640	1,790	1,940	2,095	2,240	2,405	2,580	2,770	2,960	3,145
72	1,230	1,365	1,515	1,660	1,805	1,960	2,115	2,260	2,430	2,605	2,795	2,990	3,175
73	1,245	1,380	1,530	1,675	1,820	1,975	2,135	2,280	2,450	2,625	2,825	3,015	3,210
74	1,260	1,395	1,545	1,690	1,840	1,995	2,150	2,300	2,470	2,650	2,850	3,045	3,245
75	—	1,410	1,560	1,705	1,855	2,010	2,170	2,320	2,495	2,675	2,875	3,075	3,275
76	—	1,425	1,575	1,725	1,870	2,030	2,190	2,340	2,515	2,695	2,905	3,105	3,310
77	—	—	1,590	1,740	1,890	2,050	2,210	2,360	2,540	2,720	2,930	3,135	3,340
78	—	—	1,605	1,755	1,905	2,070	2,230	2,380	2,560	2,745	2,955	3,165	3,375
79	—	—	—	1,775	1,925	2,090	2,250	2,400	2,580	2,765	2,980	3,195	3,405
80	—	—	—	1,790	1,945	2,105	2,270	2,420	2,605	2,790	3,010	3,225	3,440
81	—	—	—	1,805	1,960	2,125	2,285	2,440	2,625	2,815	3,035	3,255	3,470
82	—	—	—	1,820	1,975	2,145	2,305	2,460	2,645	2,835	3,060	3,280	3,500
83	—	—	—	—	1,995	2,160	2,325	2,480	2,665	2,860	3,090	3,310	3,535
84	—	—	—	—	—	2,180	2,345	2,500	2,690	2,880	3,115	3,340	3,570
85	—	—	—	—	—	—	—	2,520	2,710	2,905	3,140	3,370	3,600
86	—	—	—	—	—	—	—	—	2,735	2,930	3,170	3,400	3,635
87	—	—	—	—	—	—	—	—	—	—	3,195	3,430	3,665
88	—	—	—	—	—	—	—	—	—	—	—	3,460	3,700

FARMING CALENDAR.

May.

BEE-KEEPING.

Last month under normal conditions should have seen the last honey flow of the season almost ready for robbing, for which purpose have the extractor overhauled, spare crates available, bee escape boards ready, honey jars and bottles ready for usage, and also have a few spare quilts on hand. Do not rob the bees of too much honey, remembering that sending them into winter quarters with a sufficiency of food means a strong issuing colony in the spring. Any new swarms that it may be decided to add to the apiary, feed well if necessary, to induce stimulative breeding while there is time, or if new young queens have replaced older ones also feed liberally this month in the proportion of one part of cane sugar to two of water; for the somewhat wild Rhodesian bee there is nothing like the Alexander feeder let in from the back. Keep all the spaces under hive stands clean, also inspect daily to see that white ants are not building up from the soil; if this is neglected much loss may follow. When seen, sprinkle diluted kerol from a watering can under the hive stand.

Granulation in the bottled honey can be prevented by first ripening the extracted honey in large tins covered with butter muslin for three or four days by exposure to the sun's rays. It should then be heated to a temperature of 150-160 degrees—nothing higher. As soon as this is reached withdraw the tins and bottle when cooling. The best way to obtain this heating is to place the tins in another receptacle of cold water and boil it up to the required heat, as heating it direct over a fire is very liable to burn the contents or to impair the delicate flavour of the natural honey.

CITRUS FRUITS.

The harvesting of the early ripening fruit should be commenced about the first week in May. Exporters should cure their Washington Navels for a longer period than usual; this will enable them to detect the thick skinned fruit easily. Where necessary, irrigation should be continued up to within ten days of harvesting. All ploughing and cultivation should be completed without delay.

CROPS.

Continue to cut and stook maize as it matures; make the stooks small to assist drying. Later in the season the stooks may be made larger. See that the stooks are secure and pick up plants lying on the ground. Continue to plough up land between stooks of maize. Give all maize harvested, whether husked or in the husk, a chance to dry out before riding to the dumps. Do not begin shelling if the ears are still damp. Do not use new grain bags for harvesting maize. Make the dumps of unhusked ears as small as possible; the smaller the dump the quicker the grain will dry out. Grain on the cobs dries extremely slowly, if at all, in dumps of large size. Do not mix unhusked ears from the stooks with dryer ears harvested later from the standing crop. Keep the dryer ears in a separate dump; shell, bag and stack such maize separately. When cutting maize for stooking, insist on the stalks being cut within 2 to 4 inches of ground level. The plough, in Rhodesia, will not bury roots with stalks 8 to 12 inches high.

A long stubble of stalks makes clearing of the ground for ploughing very tedious and expensive. If not already harvested, ground nuts should be lifted before the first frosts damage the hay. Finish transplanting onions from seed-beds. If plants are not flourishing after transplanting, give a light dressing of nitrate of soda—50 lbs. per acre. Repeat in a fortnight if needed. Sow most winter cereals on wet vleis or under irrigation early this month. Feed your sweet potato vines to stock; if frosts occur the vines will be killed. Dig and feed tubers from end of month onwards. Towards end of month harvest cattle pumpkins and melons and handle carefully; avoid bruising to prevent rotting. Place pumpkins and melons in a dry situation in the open and in a single layer. Supply plenty of roughage to cattle pens, kraals and stables to increase the manure supply. Collect and cart manure to lands for spreading. Do not attempt to plough in dry grass or quantities of maize refuse. The plough will not turn it under and it will not rot before next planting season. Burn such refuse and make a good job of the ploughing. If the weather seems set fair, commence brick-making. A small kiln of bricks always on hand is most useful. As labour permits, re-thatch buildings and outhouses in need of repair. Overhaul, grease and paint planters, drills and other implements not required again until next season, and store away under cover. Think about your fertiliser requirements for next season and place your orders. From now onwards the second ploughing of new land broken up earlier in the season should be pushed on with as opportunity offers.

DECIDUOUS FRUITS.

The pruning of early ripening peaches should be performed this month. All holes should be completed and kept in readiness for June planting. Ploughing or digging and cultivation should be completed without delay.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family are liable to suffer greatly from cabbage louse (aphis) and Bagrada bug during May. For the former wash the plants frequently with a strong stream of cold water from a spray pump, or spray with soap and tobacco wash. Transplants may be dipped in the latter. Plants attacked by Bagrada bug may be sprayed with resin wash when the young bugs are exposed in the early morning.

Citrus Trees.—Continue to collect and destroy all fruits infested with citrus codling. Fumigate or spray for scale insects if necessary.

Guava.—Fruit fly and citrus codling breed in these fruits during the autumn and winter. Collect fruit and destroy.

Tobacco.—Watch should be kept for the emergence of the adult wire-worm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20 to 30 gallons of water. The bait should be rolled into small balls and scattered on the lands, one ball to each ten square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 10 lbs. per 10 gallons. The bait is best laid in the evening.

Fields of tobacco found to be heavily infested with gallworm should be thoroughly ploughed and cross-ploughed and laid down to an immune crop next season.

Cotton.—Continue trapping and destroying stainers. All dropped bolls should be collected and destroyed.

Maize.—Clean up storage sites, sidings and sheds against weevil.

Potatoes.—Late potatoes should be kept earthed up to prevent tuber moth from attacking the tubers.

FLOWER GARDEN.

The month of May is a suitable one for the preparation of new flower beds. The ground should be well trenched, and if of poor quality, a light dressing of well rotted manure will be a distinct advantage. Too heavy dressing is not advised, as too rich a soil is likely to produce an abundance of foliage and very few flowers. It is not too late to sow sweet pea seeds, but the best results come from early planting. By this time all bulbs for spring flowering will be planted. Chrysanthemums, delphiniums, dahlias and other herbaceous perennials may now be cut down, and if necessary taken up, divided and replanted

VEGETABLE GARDEN.

It will be necessary during the early part of the month to clear off what remains of summer crops, such as haricot beans, peas, cucumbers, etc. Where winter deep rooting vegetables are to be grown, such as carrots, parsnips and beets, the soil and sub-soil should be deeply worked, so as to allow a ready root run for these vegetables. A dressing of lime will be of great value in every section of the kitchen garden. This will especially help to minimise future attacks of insects and fungus attacks. New asparagus beds may be made this month; old beds should be cut down, cleaned and kept in good order; also a light dressing of stable manure may be given to the beds. Planting may be made of all seedlings, such as cabbage, cauliflower, lettuce, onions, etc., and seeds of carrot, leek, lettuce, onions, peas, radish, turnip, parsnip, broad beans may be sown.

FORESTRY.

Continue pricking out coniferous seedlings into tins or beds. Deciduous trees which are propagated by means of cuttings should be taken in hand. See that the fire lines are in order, and in the case of woods which have formed canopy, remove inflammable material below the edge trees.

POULTRY.

All cockerel chickens should be separated from the pullets, and every month gone over carefully, the poorer ones eliminated and only the very best kept. Those cockerels with the deep long bodies, short legs and round heads should be kept. Those with any inclination to long legs, knock knees, long heads or thin beak, lop-over combs, narrow bodies, or those lacking length and depth should be rigorously discarded. The chickens must not be allowed to become chilled, especially at night; on the other hand, they must not sleep in a hot stuffy atmosphere. On no account must they be overcrowded; this is fatal and is one of the many rocks on which poultry keepers come to grief.

The young stock must have all they can eat; to stint them is to ruin them for good and all. A bird that has been stunted never recovers. A good quality bone meal (lime phosphate) is absolutely necessary, as is also plenty of succulent green food, and no animal protein is better than thick separated milk for the health and growth of the chickens.

Those going in for ducks should hatch according to the numbers they have to supply for eating each week. Ducks must have all the food they will eat from the time they are hatched. A quick-growing duck should put on 1 lb. per week and be ready for killing at from seven to eight weeks old. Always kill or sell for killing just before the large wing feathers commence to grow.

If the rains have stopped, turkeys can be hatched. See that the youngsters are kept warm, but also that they have plenty of fresh air. Never feed young turkeys on wet or moist food, but give dry mash, grain, plenty of onion tops or onions chopped small, and thick separated milk. Keep them free from insect vermin; they will never thrive if they are infested with these.

Never allow the hen that has hatched the turkey eggs to run with the youngsters. Always confine her in a coop, through the slats of which the young turkeys can run in and out. The coop should be moved to fresh ground each day; nothing is worse for young turkeys than to be running on the same piece of ground for long at a time. Tainted ground is one of the chief causes of mortality among young turkeys.

STOCK.

Cattle.—By the middle of this month dairy cattle will require more serious attention in the matter of feed. Grass should be cut for bedding, and both cows and calves should be well bedded down at night from now onwards, and cowsheds should be put in good repair. Attention should be given to the water supplies, and care taken that they are clean and sufficient.

Boggy sources of water supply are a frequent source of loss of cattle during the winter months. With adequate water supplies cattle can withstand considerable shortage of grazing. Weaners should be fed a good roughage ration—with or without a small allowance of grain, depending on circumstances—to keep them growing through the winter months.

Get in the bullocks for winter fattening.

Sheep.—The ewes should be lambing now. It is the general experience in the Colony that winter lambs are better than spring ones. Adequate feed must be provided to keep up the milk flow of the ewes. For this purpose a stand of winter oats or barley, on which the ewes can graze for an hour a day, is excellent. A little maize with a legume hay will also give very good results. Where roots do well, they will make a valuable succulent feed for sheep. The sheep should have access to some shelter from the cold winds. Dock the lambs.

TOBACCO.

Curing should be completed as early in the month as possible to prevent loss from frost. The bales of tobacco should be examined and turned weekly until they are despatched from the farm. All bulks must be inspected regularly and turned if necessary. Tobacco seed should be shelled as soon as the seed pods are dry and the seed carefully labelled and stored in a dry place. The stumping, clearing and ploughing of new land, if operations have not already been commenced, should be no longer delayed. Land which has just produced a crop should be ploughed and harrowed as soon after the harvest as possible.

VETERINARY.

Horse-sickness will still be in evidence, and may be expected to continue until the frosts occur. Inoculation for blue tongue should be performed in the dry season only, unless the animals can be kept under cover for 21 days. Do not inoculate ewes in lamb on account of abortion. Inoculated animals spread the disease for 21 days. Scab is a poverty winter disease.

WEATHER.

During the major portion of this month the ordinary winter conditions prevail, viz., cloudless sunny days and cold nights. Frost may be normally expected at any time during the latter half of the month. There is often, however, a recrudescence of rain conditions during the early portion of the month, resulting in overcast days and light drizzling showers, the normal rainfall at many places, particularly in the southern and eastern portions of the country, amounting to over half an inch.

June.

BEE-KEEPING.

At this season hives require to be painted; the woodwork, being exceedingly dry, is in good condition to receive it. Linseed oil (unboiled) is the best kind to mix with white lead, as it is more penetrating, acting as a better preservative than boiled oil. Bees will be able to take beneficial flights during warm days, so that dysentery need not be anticipated.

CITRUS FRUITS.

Cultivation of the grove is to be continued. Early ripening fruit must be harvested and marketed without delay. Mid-season varieties will be fit for packing early in the month. These should be shipped as early as possible, so as to extend the late variety export season as much as possible. Most late ripening varieties will require irrigating during the month.

A small amount of pruning should be done. If fumigation is to take place, remove the small branches that touch the ground, cut out all dead wood and water shoots.

CROPS.

Select seed from the very best of your own crops. It is always wise to keep more seed than you may need for planting. Do not shell and ride your maize to the railway unless it is fit for export or market. If in doubt regarding the moisture content of the maize, send a 2 lb. sample in an air-tight tin, such as a golden syrup tin, to the Agricultural Department and have it tested. Provide ample dunnage for your maize stacked at the railway or on the farm. Use maize cobs; husks are almost useless for this purpose. Sew your bags of maize according to the export regulations and stack them properly at the railway side, leaving plenty of room between the double rows. Select pumpkin and melon seed from the best specimens. Support your agricultural show and make it a success by preparing and entering as many exhibits as you can. No one is more to blame for a poor show than the farmers themselves. Make a list of the seed requirements for next season, and where purchases must be made, place the orders early.

In cleaning up the cotton fields care will have to be exercised in the supervision of the pickers. The cotton harvested at this period of the season generally comes from late bolls naturally matured and those prematurely opened by the cold weather and frost. The matured seed cotton should be kept entirely separate from the immature seed cotton. There will also be some dirty and stained cotton in this final picking. Arrangements for next season's seed requirements should receive consideration.

Veld fires must be anticipated, and if not already attended to, the mowing or burning of fire-guards, both boundary and internal, should be proceeded with.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. During cold

weather it is frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

Under the cool conditions which obtain from this time of the year onwards, cheese-making operations are usually most successful.

Care should always be exercised, however, in using evening's milk. If the milk is over-acid it should not be used, or a hard, dry cheese will result. Morning's milk plus a starter usually gives the best quality of cheese. The starter should have a clean sour taste and smell. In early winter, milk for cheese-making frequently contains a high percentage of fat, and in order to firm the curd properly in the whey it is usually necessary to raise the scalding temperature a few degrees.

At this period of the year winter feeding of dairy stock should commence in real earnest. The milking cows should now be in fairly good condition, and in order to maintain a full flow of milk throughout the cold, dry months of winter, it is essential that liberal feeding be practised. As far as possible an attempt should be made to imitate summer conditions by feeding an abundance of succulent and palatable food. Maize silage, sweet potatoes, pumpkins, etc., are very useful for this purpose, but these feeds should be supplemented by dry roughage of good quality, preferably a legume hay, and a liberal allowance of mixed concentrates.

For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

DECIDUOUS FRUITS.

General pruning may be done this month if the leaves have fallen. This should be confined, as far as possible, to the thinning out of diseased, weak, broken and dead shoots. Tall trees may be reduced in height, and old and unprofitable trees headed back to induce the growth of new fruiting wood. Trees that shed their leaves late may be pruned in July. The necessary preparations for planting trees should be completed during the month and planting commenced towards the end of the month. Cultivation should be continued.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during June.

Onions.—Suffer from thrip. The transplants may be dipped as far as the roots in tobacco wash or paraffin emulsion to keep down the pest.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

FLOWER GARDEN.

Annuals for early spring flowering should be sown, preferably in paraffin tins cut lengthwise, in a place sheltered from the wind. Perennials, shrubs and ornamental tree seeds may also be sown. Fruit trees, shrubs and roses should be pruned and all dead wood removed. Sweet peas require constant attention.

VEGETABLE GARDEN.

All the available space in the garden should now be thoroughly trenched and manured, the soil being well worked and loosened. Vegetables planted out for winter crops should be well and continuously cultivated, which will help to bring them along quicker and with less

watering. Late-bearing tomatoes should be sheltered from the cold winds by a grass shield. Beet, radish, carrot, parsnip, turnip, onion, leek, mustard, cress and tomatoes may be planted.

FORESTRY.

Care should be taken by further ploughing of land or burning of grass that all fireguards round plantations are in good order and effective. Thinnings where necessary may be continued, and fellings which are to be made are to be carried out. Cuttings may be taken and struck now of deciduous trees, such as the Carolina poplar. The pricking out of conifer seedlings into tins should be continued, and sowing of such seed for the coming planting season may be completed. A commencement may be made of preparation of land to be planted during the ensuing season, e.g., by stumping if necessary, and ploughing where practicable.

GENERAL.

Grazing is deteriorating, and the next few months may be a period of difficulty for the rancher. It is a mistake, frequently seen, for all the grazing nearest to the drinking places to be first consumed, so that later on the cattle, when least able to endure fatigue and when the grass is in any case most scanty and dry, have furthest to walk from the feeding ground to water. A little forethought can obviate this trouble. Live stock are usually in good condition at this time of year and able to travel longer distances to water than may be the case later on in the season. Fire guards to prevent grass fires should be looked to.

POULTRY.

The poultry keeper must be on the look-out for sudden cold snaps, for if some precautions are not taken, the production of eggs will drop.

This is one of the poultry keeper's busiest periods, but method, cleanliness and attention to details pay him well. Do not leave anything that you can spare the time to do yourself to natives. Watch carefully your breeding birds, and on the slightest sign of one going off, take him or her away; if left, you will have infertile eggs, weak germs, weak chicks difficult to rear, and later weak and unprofitable stock. See that the male bird has all the food he requires, and give him a meal by himself twice a week, also a small piece of raw meat three times a week. Those who are using incubators should watch the temperature of the room on cold nights, for variations in temperature result in delayed and poor hatches, and often deformed chicks.

STOCK.

Cattle.—Cows with autumn calves should be kept in the more sheltered paddocks. A watchful eye should be kept on all watering places in order to prevent their being fouled or stopped up. Where winter calves are required, the bulls should be kept out of the herd until the end of July at least, and, in the meantime, they should be well fed and cared for in order to fit them for their work. The three watchwords in the dairy herd should be feed, shelter and bedding from now onwards. Ensilage will now be found invaluable, as also will pumpkins, majordas or any other form of succulent food. Good hay should be used to rack up with at night, and the maize ration should be supplemented with ground nuts, ground nut cake or bean meal. Young calves are better in the pen on very cold mornings until the sun has gained some power, when they may run on short, sweet veld for a few hours.

Sheep.—Continue to feed the ewes and lambs well. Older sheep should generally also be given some supplementary feed now. Sheep should not be allowed to get into low condition, especially in areas where parasite infection is to be feared.

TOBACCO.

The grading of tobacco should be proceeded with. Any bales stored on the farm should be turned occasionally, especially where more

than one bale is placed on another. Arrangements for the grading of tobacco seed should be made for the coming season. Growers purchasing tobacco seed should place orders early with distributors of reliable seed.

VETERINARY.

Horse-sickness should be practically over now. Redwater and gall-sickness occur all the year round, but the worst time is the summer, when ticks are prevalent. Blue tongue should be very little in evidence now. Inoculation can be carried out now. Scab is a poverty winter disease.

WEATHER.

Casual rains may occur, but except on the eastern frontier, none is to be reckoned upon, nor can it be regarded as seasonable or desirable. Frosts generally occur on a few nights during the month of June, and precautions must therefore be taken. This month and the next are the coldest of the year, and when the cold is accompanied by dull weather or "Scotch mist," known locally as "guti," it is apt to have a severe effect on live stock, especially if grazing should at the same time be scarce and water supplies far to travel to.

GWEBI PRODUCE PRICES.

Hull-less oats	40/- per bag of 150 lbs.
Large Black sunflower seed ...	14/- per bag of 100 lbs.
Dolichos beans	35/- per bag of 200 lbs.
Linseed	60/- per bag of 200 lbs.
Linseed (quantities under 100 lbs.)	4½d. per lb.
Sweet potato tubers (Calabash Leaf)	6/- per bag of 150 lbs.
Napier fodder roots	6/- per bag of 40 lbs.
Sweet potato cuttings (Calabash Leaf)	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.
Pumpkin seed	1/1 per lb.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

SOUTHERN RHODESIA VETERINARY REPORT.

January, 1932.

AFRICAN COAST FEVER.

The slaughter of the infected herds on Hillside Farm, Melsetter district, was completed. No further infection occurred.

FOOT AND MOUTH DISEASE.

VICTORIA VETERINARY DISTRICT.—Two farms became infected in the Chilimanzi district and one in the Victoria district and a spread of infection occurred in the Nyadjena Native Reserve and Crown land adjoining. The mixing of healthy and infected herds has been carried out to hasten the spread of infection.

GWELO VETERINARY DISTRICT.—A fresh outbreak occurred on a farm in the Charter district which spread to the adjoining farm. This district has been free from the disease for several months and the origin has not been traced. The progress of the disease in the Chilimanzi Native Reserve has been very slow and infection has now spread to three farms adjoining. The conditions in the other areas are satisfactory and infection is clearing up.

BULAWAYO VETERINARY DISTRICT.—In the Ntabazinduna Reserve and the Shangani Ranch, Bubi district, the disease has been active and spreading throughout.

In the Belingwe district the disease is clearing except in the Belingwe Native Reserve, where inoculation is being carried out. The inoculated cattle in the Gwanda area were returned to the kraals and no further signs of the disease were found on Liebig's Ranch. This and the Tuli area are now considered clean.

Salisbury Veterinary District.—All the cattle in the northern section of the Chiweshe Reserve, Mazoe, were inoculated and the reactions were satisfactory. On one of the previously infected farms in the Salisbury district a calf was found to be infected and on inspection it was discovered that lesions existed in several of the calves born previously. These were the only two active areas during the month.

MYIASIS: SCREW WORM IN CATTLE.

This is prevalent in most districts.

TRYPANOSOMIASIS.

This disease has been spreading somewhat on the eastern border, Melsetter district; eight new cases have been reported.

SEPTIC PNEUMONIA IN CALVES.

Many cases were reported in the Gwelo district and on one farm eleven deaths resulted.

PIROPLASMOSIS.

A serious outbreak of this disease occurred on a farm in the Salisbury district amongst cattle recently removed and not regularly dipped. Seven head died and many were seriously affected.

OPHTHALMIA.

Cases have been reported from many areas.

IMPORTATIONS.

From the Union of South Africa: Horses 2, sheep 1,666, goats 265.

EXPORTATIONS.

Nil.

February, 1932.

AFRICAN COAST FEVER.

An extension of the disease occurred on the farm Springvale, Melsetter district. This farm adjoins the previously infected areas Hillside and Tilbury Estate.

Prior to the diagnosis of the disease at Tilbury in May, 1931, a span of oxen travelled from that estate to Melsetter and spent the night in a camp on the town lands. As it was suspected that some of these animals might have carried the disease, a few cattle were placed in this camp in June and kept undipped for testing the existence of infection. One animal showed a rise of temperature on the 25th February and smears and *post-mortem* examination proved the existence of Coast Fever.

The fact of these oxen having carried infection to the Melsetter town lands shows that in all probability the farms *en route* will also be infected.

FOOT AND MOUTH DISEASE.

Gwelo Veterinary District.—The disease appeared on a farm adjoining the Central Estates, Chilimanzi district, where the cattle were dipped, and infection spread to three camps on the estate. The disease is practically cleared up on the two farms in the Charter district and has cleared up in six farms in Selukwe district and in the Lundi Reserve, Belingwe district.

Victoria Veterinary District.—An outbreak occurred in the Mtilikwe Native Reserve, Victoria district, and the spread of the disease is being hastened by contact, which has been satisfactory at the Nyadjena Native Reserve.

The position in this veterinary district is satisfactory. Active infection exists only in the southern portion of the Victoria district.

Bulawayo Veterinary District: *Bubi District.*—The disease is now cleared up in the Battlefields Block and Ntabazinduna Reserve and on the latter was kept within the cordon line. In the Shangani Ranch it is still running its course.

Belingwe District.—A farm on the north of the Belingwe Reserve became infected and the cattle there and adjoining will be inoculated. The inoculation of all the herds within the cordon on the Belingwe Reserve has been completed.

Salisbury Veterinary District.—A few cases have occurred within the inoculated area on Chiweshe Reserve, Mazoe district, amongst a herd that did not react to the virus, but passed through with natural infection.

MYIASIS: SCREW WORM IN CATTLE.

The screw worm is very prevalent, especially amongst cattle infected with foot and mouth disease, where it aggravates matters.

HORSE-SICKNESS.

Deaths have been reported from the following districts: Charter 3, Gwelo 2, Mazoe 3, Umzingwane 1.

TRYPANOSOMIASIS.

A few cases occurred in Wankie district, and on several farms in the Gatooma area. Two deaths in the Melsetter district.

SWEATING SICKNESS.

There has been an unusual number of calves reported suffering from this ailment.

IMPORTATIONS.

From the Union of South Africa: Bulls 6, heifers 35, horses 5, sheep 2,233, goats 125.

EXPORTATIONS.

Nil.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA WEATHER BUREAU.

MARCH, 1932.

Pressure.—The mean barometric pressure was generally above normal, except in the north.

The equatorial low was very active during the early part of the month; it extended into Southern Rhodesia on the 1st and 2nd and withdrew on the 3rd, extending to the

south from the 4th to the 7th, and was over Southern Rhodesia on the 8th and 9th. The withdrawal commenced on the 10th. On the 13th it again extended to the south-west coast, but broke up on the 15th, leaving a detached low on the south-east coast. Pressure then commenced falling in the north-east and remained very low over Madagascar to the end of the month. No lows of any importance appeared on the south coast.

A high appeared on the west coast on the 1st, and it moved round and reinforced the pressure on the east coast on the 3rd. A second high appeared on the south coast on the 10th and remained on the south-east coast until the 13th. The third was a rapid moving high; it was off the west coast on the 15th and the east coast on the 16th, and moved into the Limpopo Valley on the 18th. The fourth and fifth appeared on the south coast on the 19th and 21st, and established the semi-permanent high which covered South Africa with minor fluctuations to the end of the month.

Temperature.—The mean temperature for the month was generally below normal; the minimum temperatures were normal or slightly above, but the maximum temperatures were low.

Rain Periods.—Rain was fairly continuous from the 1st to the 16th; from the 1st to the 8th it was fairly general, but slackened off on the 9th; it was again fairly general from the 10th to the 16th; scattered showers were recorded on the 17th and 18th, and the weather was mainly fine for the rest of the month.

Rainfall.—The rainfall for the month was 7 inches, or 3 inches above normal, distributed as follows:—

	March, 1932.	Normal March.
Zone A	7.3	3.3
Zone B	5.3	2.9
Zone C	5.6	4.6
Zone D	7.8	5.0
Zone E	9.2	4.9
Zone F	12.1	9.0

The seasonal total is 26.8 inches approximately, or 0.3 inch below normal.

MARCH, 1932.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen ° F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet).
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal.	No. of Days.	
Bulawayo ...	868.6	868.2	83	48	75.8	59.1	67.5	69.0	65.3	61.7	82	60	6.7	5.88	3.3	13	4,436
Gwelo	862.3	...	81	48	75.9	58.3	67.1	69.6	65.0	61.8	83	60	5.0	10.07	3.3	13	4,632
Riverbank ...	...	...	88	49	79.8	60.9	70.4	71.7	68.6	64.1	78	62	...	7.45	4.1	15	4,100
Essexvale ...	...	...	93	51	81.5	61.1	71.3	71.1	66.0	62.7	83	60	...	11.16	3.8	13	3,828
Gwanda ...	906.6	...	90	53	79.0	61.3	70.2	...	69.8	64.0	73	61	4.6	5.49	2.0	11	3,235
Mazunga ...	948.1	947.7	91	55	84.1	63.2	73.7	76.4	73.2	67.4	74	65	5.7	0.96	2.2	7	1,970
Nuanetsi ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2.6	...	1,630
Between Rivers	...	...	86	50	81.8	58.8	70.3	...	67.3	64.3	85	63	5.1	4.28	6.2	16	3,970
Enkeldoorn ...	...	...	81	47	76.3	57.5	66.9	68.7	65.3	61.8	82	60	6.7	8.17	3.8	16	4,720
Gatooma ...	...	...	85	50	81.0	59.2	70.1	72.7	69.1	64.7	79	63	4.9	7.31	4.2	12	3,850
Miami	...	...	81	55	78.4	61.2	69.8	...	67.3	64.0	84	62	6.3	2.12	5.5	11	4,090
Salisbury ...	854.9	855.1	82	50	78.3	57.9	68.1	68.6	66.5	61.6	76	58	6.6	3.10	6.0	13	4,865
Sinoia, Citrus ...	...	...	84	53	80.0	60.0	70.0	...	67.6	63.6	80	62	...	3.86	4.0	10	3,830
Sipolilo... ...	...	...	82	53	77.9	60.8	69.4	...	68.8	64.3	78	62	5.2	3.67	4.1	11	3,900
Juliasdale ...	...	...	75	45	69.6	53.3	61.5	62.4	64.5	60.4	79	58	...	10.03	9.1	18	6,070
Mtoko	...	...	80	51	77.7	60.0	68.9	...	67.0	63.7	84	62	7.2	10.41	3.5	14	4,210
Shamva ...	...	...	86	53	81.6	64.0	72.3	...	71.0	67.8	85	66	6.8	4.94	4.8	18	3,170
Angus Ranch ...	...	...	88	57	80.9	66.2	73.6	75.1	71.2	67.5	83	66	...	5.24	5.0	13	2,300
Craigendoran ...	...	...	87	52	82.4	61.0	71.7	...	71.2	66.8	79	64	...	12.78	6.2	17	3,430
New Year's Gift	...	...	85	55	79.3	62.2	70.8	...	69.2	65.5	82	63	...	7.15	4.3	17	2,700
Nyamasanga ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5,080
Riverdene North	...	...	89	46	79.7	58.5	69.1	...	66.7	63.5	84	61	...	8.78	5.3	14	3,700
Stapleford ...	...	...	76	40	70.0	54.4	62.2	...	62.3	59.8	87	58	6.6	18.90	12.1	18	5,450
Umtali	892.7	892.1	85	52	77.8	61.0	69.4	70.6	68.7	64.8	81	63	7.1	11.75	5.3	17	3,677
Victoria ...	895.7	895.1	85	50	77.7	59.8	68.8	69.0	68.1	63.8	79	62	4.9	7.69	3.7	12	3,570
Melsetter ...	850.5	...	78	48	72.3	55.8	64.1	...	63.9	60.6	83	58	6.2	14.36	7.7	19	5,060
Mount Selinda	...	...	82	53	73.8	60.5	67.2	...	65.3	63.4	90	62	6.3	15.99	11.7	17	3,520

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Tuberculosis, by A. Little, Poultry Expert.
Diseases of the Liver, by A. Little, Poultry Expert.
Prevention of Disease among Poultry, by A. Little, Poultry Expert.
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No. 554. Pisé-de-Terre, by P. B. Aird.
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How to Make Use of the Fencing Law.
Twelve Simple Rules for the Avoidance of Malaria and Blackwater.
Summary of the Game Laws of Southern Rhodesia

THE RHODESIA

Agricultural Journal.

Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).

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EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Export of Meat.—The export of meat to the United Kingdom has been brought a stage nearer by the organisation of the Cattle Owners' Association.

Hitherto, the only overseas market of importance for our beef has been the Italian Army contract. While this market offers an opening for a considerable number of cattle —20,000 to 30,000 at present—it is not sufficiently secure nor large enough to absorb the surplus of cattle accumulating in the Colony. It is anticipated, therefore, that the efforts of the Association to get in touch with the Smithfield market will be of much value to the Colony.

The United Kingdom absorbs about two-thirds of the frozen beef moving into international trade, importing in 1930 one and three-quarter million cwt. of frozen beef and approximately a similar quantity of canned meat and frozen entrails. There should be an opening on this amount for

all the frozen beef Rhodesia can produce until such time as the quality of our cattle has been improved sufficiently to make the export of chilled meat practicable on an economic scale.

The preliminary trial exports which have been planned will not take many head of cattle out of the country, but they will serve to bring Rhodesian beef to the notice of the chief world market and give producers in this Colony some experience in the requirements of the meat trade. This experience will be of great value when the present veterinary restrictions on export are removed.

The present intention is to export this meat via Beira, making use of the one Lightfoot-Stone refrigerator truck now available. This truck has a capacity of about 13 tons of frozen meat. Eight similar trucks have been ordered, which should be in commission by the end of this year, giving a capacity of 100-120 tons of frozen meat per train load. This meat will be loaded from the trucks direct on to the boat, or held at a low temperature in the trucks at Beira if the ship is not ready. Unfortunately no suitable cold storage is available at Beira to store the meat.

As a beginning it is planned to send a trial shipment of 10 tons of "vealers" to Smithfield. These so-called "vealers" are in reality something between "brown veal" and "baby beef," and the shipment has been planned to test the reaction of the market to this type of meat. The calves will be shipped on commission by the Rhodesia Cold Storage and Supply Company, and any loss or profit will be borne by the breeders co-operating in this experiment.

Locusts.—In our March issue we published a warning regarding a possible invasion of the Colony by the red locust. At that time there was a distinct danger of swarms originating from the Fesheke district in Northern Rhodesia flying south into Matabeleland. Later news is more reassuring. Recent reports from Northern Rhodesia indicate that these locusts have flown in a south-westerly direction into the Caprivi Strip and Northern Bechuanaland. This direction of flight is particularly interesting, as swarms of this species of locust

have maintained a steady south-westerly direction of flight ever since they crossed over into Northern Rhodesia from the Belgian Congo in 1930. Other flying swarms bred out from eggs deposited in the Kafue Flats have turned north.

Flying swarms of both the European locust and the red locust are present in neighbouring territories on the north, south and west, and an invasion may possibly occur later in the year. Fortunately the main crops are now too far advanced to suffer serious damage in the event of an invasion occurring within the next few weeks.

Tobacco Research.—About a year ago Dr. C. W. B. Arnold, who is in charge of the Imperial Tobacco Company's Experiment Stations in Nyasaland, visited Salisbury and assisted in laying down the programme for tobacco research to be undertaken on the Salisbury Station.

In Nyasaland he is investigating the tobacco problem chiefly from the chemical standpoint, and it was decided that we should devote our attention more especially to the cultural and plant breeding aspects.

Dr. Arnold has been paying particular attention to the chemical composition of cured tobacco leaf, to account for, if possible, the difference in burning quality, flavour and aroma which is known to exist between tobacco grown in Nyasaland or Southern Rhodesia and American grown leaf.

Numerous analyses of leaf tobacco have shown that, by comparison with American leaf, African grown tobaccos contain a much smaller percentage of chlorine. A portion of the chlorine in tobacco is vaporised during smoking, but the major portion is retained in the ash. From an analysis of cigarette grades of American leaf the percentage of chlorine found in the ash varied from 5 to 12 per cent. The comparative figures for Rhodesian leaf are only 1.1 to 1.9 per cent.

Dr. Arnold found that under greenhouse conditions it was possible to introduce chlorine into Nyasaland leaf by the application of muriate of potash and common salt. In some cases it was shown that from 5 to 10 per cent. additional

chlorine remained in the ash when the tobacco had been fertilised in this way. Under field conditions, however, it was found that the amount was considerably less and it was considered probable that the difference was due to the leaching effect of heavy rains.

When the above tests were made it was impossible to ascertain from the literature the origin of the chlorine in the American leaf, since none of the published analyses of American soils showed an unusual amount of chlorine. To enable this point to be decided the Imperial Tobacco Company obtained samples from six well-known tobacco districts in America for analysis, and it was found that the chlorine content was very similar to that which had been shown by analysis to be usual in Nyasaland and in Southern Rhodesia. Since the chlorine content of the leaf could not be accounted for by the soil, the company obtained six samples of the commercial tobacco fertilisers in general use in the United States of America, and the analysis showed that they all contained chlorine in amounts up to 3 per cent.

The tobacco fertilisers used in the United States of America have generally been bulky, organic mixtures which are known to contain a higher percentage of chlorides than is found in the high-grade fertilisers which are generally employed in Africa in order to save transport charges. It would therefore appear that the origin of the additional chlorine found in American tobacco is in the low-grade fertilisers which are used.

In a report of investigations on the fertiliser treatment of tobacco under American conditions, published in the Journal of Agricultural Research in 1930, it was suggested that chlorine actually improved the market value of tobacco, and that the maximum benefit was derived by applications of from 20 to 30 lbs. per acre. Muriate of potash (95 per cent.) contains 45 per cent. of chlorine, and common salt of the grade commonly used in this country contains 56 per cent. of chlorine.

Dr. Arnold suggests that even a higher dressing than that suggested in the bulletin referred to would be necessary with our rainfall conditions to produce similar effects to those obtained in American leaf, and his field experiments showed

that the yield per acre was not reduced by the application of even 50 lbs. of chlorine per acre nor was the valuation lowered. He has not been able to complete experiments on flue-cured tobacco which could be tested when made into cigarettes, but experimental plots receiving varying amounts of chlorine in the fertiliser used were planted this last season on the Salisbury Tobacco Research Station. Arrangements will be made to have representative samples from these plots submitted separately for detailed reports regarding manufacturing, burning and smoking quality, etc. These are points of great importance and it is hoped to be able to make more definite recommendations regarding the application of chlorine based on the results obtained before the next planting season.

A Ration for Poultry.—During the last few years experiments have been carried out on the Salisbury station to determine a suitable economic ration for rearing heavy and light breeds of poultry from hatching to maturity.

The following has given such satisfactory results that it is now recommended by the Poultry Section for general adoption.

For a grain mixture, it is suggested that munga may be fed alone from the time of hatching until the chicks are eight weeks old, thereafter six parts of crushed mealies should be added to every four parts of munga.

For the mash mixture—

Mealie meal	45 lbs.
Bran	10 lbs.
Pollard	17 lbs.
Oats (rolled or meal)	10 lbs.
Monkey nut cake	10 lbs.
Bone meal	2 lbs.
Limestone or powdered oyster shell	1 lb.
Charcoal	1 lb.
Fine salt	½ lb.

are mixed together. For the first three months it is desirable to add about eight per cent. blood meal or meat meal unless

thick separated milk is available, when this may be reduced to five per cent.

An ample supply of finely chopped green food should always be available, as is also the case with grit, oyster shell and charcoal. These are most economically supplied in hoppers.

Tung Oil.—The use of tung oil has become so firmly established in the paint and varnish industry that during the last ten years or so attempts have been made to grow this tree in many parts of the world. At the present time the only source of commercial supplies is China, from which over 69,000 tons were exported in 1930. Thousands of acres have been planted out in America—which is the largest consumer at present—mostly in the Mississippi Valley and Northern Florida. On the whole, the yield of fruit in the southern States has not come up to expectations, and it is feared that the late spring frosts which often occur when the trees are in blossom account for the poor yields which have so far been experienced.

During the last four years the Imperial Institute, with the assistance of the Royal Botanic Gardens, Kew, has been endeavouring to get experimental plantings made in different parts of the Empire. Nearly four tons of seed of *Aleurites fordii* have been distributed, and trials are now in progress in Australia, New Zealand, New Guinea, India, Ceylon, Mauritius, the Union of South Africa, Kenya, Tanganyika, Nyasaland, and several other Colonies.

In all these places the cultivation is still in the experimental stage, and in no case has it yet been established that trees on a commercial scale will prove remunerative.

In India the principal trials are being conducted in Burma and Assam. On one estate an attempt has been made to plant 1,200 acres, and in 1930 some 35,000 seedlings were raised.

In Ceylon it is apparently accepted that *Aleurites fordii* will not flourish, but *A. montana* on the other hand appears to grow well.

In Australia a company has been formed which proposes to establish a 1,000-acre plantation at Sydney, and experimental trials in Queensland seem to indicate that *A. fordii* can be grown commercially there.

In New Zealand no less than five public companies have been formed to develop the tung oil industry with a total nominal capital of £780,000, and at several centres areas up to 500 acres in a block have been prepared for planting.

In the Union of South Africa results with *A. fordii* have not been uniformly satisfactory.

Trials made in other parts of the Empire have not been uniformly encouraging, and it has been suggested that failure is often due in the case of *A. fordii* to the absence of a proper dormant season, which appears to be essential for that particular species.

The cultivation of the tung oil tree is also being attempted in several of the South American States. It is estimated that at the end of last year in one centre of the Argentine over 56,000 trees were being grown, while in Paraguay there are about 30,000 trees, generally in small plantings of from 25 to 500 each.

Several questions arise at the present time in connection with attempts to establish tung oil trees in new areas with the object of achieving the production of oil on a commercial scale.

It appears that *A. montana* will flourish in districts where *A. fordii* will not, and an authoritative opinion on the relative merits of the oil obtained from these two species would be of great interest. From the tests which have already been made it would seem that the real tung oil which is derived from *A. fordii* has a greater commercial value than that obtained from *A. montana*, which is known in China as Mu-Yu oil.

The influence of the increased production on the price of oil is another point of importance to those who are contemplating planting trees on a commercial scale. During the recent general depression the price dropped from £69 10s. per ton in January, 1930, to £37 10s. in September, 1931. This can be accounted for entirely by the general depression

of prices for all commodities, and it is considered that tung oil will always command a price at least £10 above that of linseed oil on account of its special properties, which are now considered essential in the manufacture of certain types of paints and varnishes. If greater quantities were available there is no doubt that the present list of uses could be considerably enlarged.

A potential new use for the oil is in the linoleum industry, where it is estimated that tung oil could be used to great advantage in place of linseed oil. Should that be the case, the present British demand would be practically doubled, as the linoleum industry in the United Kingdom alone uses some 50,000 tons of linseed oil annually.

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

REPORT OF THE DIVISION OF IRRIGATION

FOR THE YEAR ENDED 31st DECEMBER, 1931.

By C. L. Robertson, B.Sc., A.M.I.C.E.

Unfortunately the steady progress of the work of the Division recorded in previous reports was not maintained during the year under review, owing to the prevailing abnormal depression, forcing farmers and others to considerably restrict development and be chary of embarking on any new schemes.

It is worthy of note, however, that the demand for advice in soil erosion protection works and for the services of the Government boring machines has been practically maintained at the high level reached in the previous year, and is a cheering indication that farmers still have faith in the future of the industry in this Colony.

The general restriction of credit resulted in only one grant from the Irrigation Loan Fund being approved, although there were the usual number of applications.

The general need for economy resulted in instructions being received for no further investigations to be undertaken by the Reconnaissance Survey Party after completion of the survey of the Popotekwe Project, and it is unlikely that it will be possible to maintain this party in the field during the coming year. This is regrettable, as it is only the early and complete investigation of these larger projects which will enable sound development to be undertaken at a later date.

The investigation work of the party is bearing fruit, as it is probable that the construction of three flood storage schemes of fair magnitude in Matabeleland will be undertaken during next year.

As usual the work of the Division has been of an extremely varied nature.

The summary below gives the approximate expenditure controlled and administered by this Division, together with the estimate of cost of works advised upon during the calendar year, exclusive of ordinary advisory work.

SUMMARY.

General boring operations	£12,510
Development and installation water supplies in native reserves	11,235
Installation water supplies, Government institutions and townships	5,550
Surveys and estimates for water supplies, Government institutions and townships	8,200
Engineering works for Agricultural Department	3,350
Advances approved from Irrigation Loan Funds ...	100
Conservation works, native reserves	600
Surveys and estimates, conservation works, native reserves	1,100
Meteorology and hydrology	850
Reconnaissance survey	1,000
	£44,495

General.—The following summary shows the number of visits paid to farmers and others in connection with irrigation, soil erosion, water supplies and general engineering:—

Farm visits in connection with irrigation	102
Farm visits in connection with soil erosion	129
Visits townships and Government institutions	75
	306

Acreage of new irrigable land investigated	4,865
Total acreage of irrigable land investigated to end of 1931	55,063

The above acreage of irrigable lands includes 3,000 acres under the Umshandige Project, which was investigated by the Reconnaissance Survey Party in 1930, but not previously included, as the exact acreage irrigable was not determined.

Two farmers' association meetings were attended and addresses delivered on soil erosion. Twelve lectures in agricultural engineering were delivered to the pupils at the Matopo Agricultural School.

The construction of residences and farm buildings at the Sand Veld Experiment and Pasture Research Station, together with the provision of a water supply to the various paddocks, was supervised. The construction of the furrow in the Mutema Reserve was continued, but unfortunately the early onset of heavy rains this season delayed its completion.

In addition, two weirs for the conservation of water were completed in two of the Southern Matabeleland reserves, where boring has failed to develop useful supplies. The funds for the construction of the furrow and the weirs were provided from Native Reserve Trust Funds.

Surveys and estimates were prepared in connection with nine water supply schemes for small townships and Government institutions, six of these schemes being completed during the year, viz., those supplying Chipinga School Hostel, Gomohura Leper Settlement, Selukwe Government Institution, Plumtree School, Fort Usher and Bembesi Police Camps. The water supply scheme serving Bindura township was completed, and surveys and estimates were prepared in connection with water supply schemes for Selukwe and Shabani townships. Advice was also given to Gwelo Municipality regarding their proposed water supply scheme.

The number of visits paid this year on all matters falling within the scope of the Division is 306, a decrease of 102 below the previous year's total, but practically identical with the total for 1929. This decrease is partly due to farmers restricting development owing to the difficult financial position, and partly due to shortage of staff owing to the Irrigation Engineer (Matabeleland) being on long leave.

The number of visits paid for soil erosion advice also shows a small decrease, but the amount of work performed is very much greater, as is shown in a summary given later.

Investigations were carried out during the year by members of the Division in fuel consumption of petrol-alcohol mixtures in motor car engines and on the Macdonald

High-Speed Producer Gas Attachment for use on tractors and motor vehicles. The results of these investigations were published in separate reports.

At the request of the Beira, Mashonaland and Rhodesia Railways a special visit was made to the Deka Falls railway deviation, and advice was given on matters relating to the provision of water for railway purposes along the route.

Irrigation research plots were laid out at the Matopos School of Agriculture with the object of determining the effect of various applications of water on the yields of lucerne, wheat and mixed pastures, and it is intended to commence observations there next season. This is a subject of investigation which has been long overdue, as no exact date is available for the water duty requirements of these crops under local conditions.

Irrigation Reconnaissance Survey.—The survey party carried out field work from the beginning of May until the end of October in connection with the Popotekwe Gorge Project in the Victoria district, the Umgusa Scheme in Bulawayo district and a small individual scheme on Southill Ranch in the Gwanda district.

The work carried out on the Popotekwe Project consisted of a detailed survey of the gorge, tacheometric survey of high and low level canal routes on both banks and demarcation of suitable irrigable land. Levels were run for a distance of 90 miles for the various routes on both banks, and a detailed band survey made for canal location on a distance of 52 miles allocated as under, together with approximate irrigable area.

	Irrigable area. Acres.
Low level canal, right bank (18 miles)	2,800
High level canal, right bank (13 miles)	3,200
High level canal, left bank (21 miles)	1,000

The low level canal is 40 feet and the high level canals 70 feet above river bed level at the gorge. The storage capacity of the reservoir basin has not yet been accurately determined, but preliminary calculations show that there is practically no storage below 40 feet; at 70 feet the storage is 17,000 acre feet, which is increased to 30,000 acre feet at 80 feet, with very considerable increase in storage above this level.

Owing to the extent of the catchment (413 square miles), the minimum run off in a year of low rainfall will probably not be less than 12,000 acre feet, and would be over 26,000 acre feet in the great majority of years.

As a scheme for development in the near future it is obvious that a dam 70 feet in height would suffice to provide storage for the irrigation of 2,800 acres, under the low level canal on the right bank only.

The site, however, is such a favourable one for the construction of a large storage dam to conserve the surplus storm water available in years of heavy rainfall that the survey was extended to obtain data as to the storage available at higher levels. The construction of a dam 100 feet in height would enable water to be passed down the river for the irrigation of land in the semi-arid areas of the low veld, and, by the development of power, permit of water being pumped into the high level canals for the irrigation of land in the immediate vicinity of the dam site.

When the data from the survey are reduced and plotted this matter will be investigated in more detail.

After survey of this project was completed in September a rough preliminary reconnaissance survey was carried out on the Umgusa Project, which revealed that a dam could be constructed to store sufficient water for the irrigation of 220 acres at a cost of £6,000. As this scheme is situated in the near vicinity of Bulawayo it is possible that this scheme may be constructed in the near future.

In addition, a survey was made of a small storage scheme on Southill Ranch, Gwanda, which would suffice for the irrigation of 40 acres of land at a cost of £1,300. It is probable that this scheme will be constructed next year.

As previously mentioned, it has been decided to discontinue the field operations of this party next year owing to the urgent need for economy, but I wish to place on record my appreciation of the excellent work carried out by the members of this party during the 2½ years they have been in operation.

The necessity for the early and thorough investigations of this nature is not commonly recognised, and in this connection the following remarks by John W. How, Director

of Agriculture, Northern Pacific Railway Company, are of value :—

"There is widespread failure to realise among our own people that the premises in a decision to expand or not to expand irrigated lands are not reposed in conditions now existing, but rather they are those which will obtain many years hence when the new projects now contemplated are constructed, settled and have come into production. Proposed projects, particularly the large difficult ones, require many years for completion of surveys, economic and engineering, for construction of works and additional years for securing sound settlement."

Irrigation.—The number of new small irrigation schemes advised on favourably during the year have totalled 40, with a potential irrigable area of 1,865 acres, and the Umshandige Project with an irrigable area of 3,000 acres. It is encouraging to note that there has been a distinct advance in irrigation development in Matabeleland during last year, as the following remarks by the Irrigation Engineer show :—

"The visits to private applicants resulted in the construction of one weir for conservation of water for stock purposes, one small masonry dam to irrigate land and the projected construction of four schemes capable of irrigating a total acreage of 105 acres. Of these four latter schemes, one of 20 acres is definitely proceeding to construction, whilst the remainder for 50, 20 and 15 acres respectively will almost certainly be constructed."

From information supplied by the Government Statistician it appears that the area under winter crops (mainly irrigated) in 1930 again showed an increase over that recorded in the previous years, the totals being 13,990 acres and 11,760 acres respectively, i.e., an increase of 19 per cent. The area under wheat again showed a very marked increase of 50 per cent. over the previous year, viz., 4,600 acres to 6,910 acres, but the average yield unfortunately had decreased from 2.8 to 2.3 bags per acre, owing to a considerable portion of the crop being grown in vlei lands without irrigation.

In the last two years the area under wheat has been more than doubled, having increased from 3,300 acres to 6,910 acres.

The value of wheat and wheaten products imported during the year stood at the high figure of £96,309, of which £38,817 was re-exported.

The area under winter potatoes was practically the same as in the previous year, viz., 870 acres, as compared with 900 acres, and the average yield was maintained at 20.5 bags per acre. The declared value of the potatoes imported was only £12,268, showing a sharp decline from the previous year's figure of £23,873, but the decline was mainly due to the lower value of the product, as the declared value per bag in 1930 was only 8s. 7d., as compared with 13s. 4d. in the previous year.

The area under lucerne was practically stationary at 240 acres.

Considerable development was made on the Sabi-Tanganda Estate during the year, and an additional grant was obtained for the irrigation of a further 600 acres. In this area of low rainfall summer crops are being grown under irrigation, and it is intended shortly to have over 1,000 acres under cultivation.

Soil Erosion.—The number of applications for advice on this subject shows a slight decrease over those dealt with in the previous year, but the amount of work actually carried out has been steadily increasing, as the following summary shows:—

Year.	Miles of contour ridges pegged.	Area of land protected.
1929	76	2,280
1930	103	3,100
1931	150	4,500

Although these figures are encouraging it will be realised that the rate of progression is still too slow when it is considered that there are over 200,000 acres under summer crops in this Colony and that a considerable percentage of this requires protection. Contour ridges were set out on three farms in Matabeleland during the year, so that it is evident that the need for this form of protection is being realised in all parts of the Colony.

The Executive of the Rhodesia Agricultural Union has appointed a special sub-committee to deal with soil erosion

policy, and will co-operate with officials in the various Government Departments concerned and with the railways, in order to obtain some measure of co-ordination on this vital matter.

This is a distinct advance in the right direction, and the results of the committee's action will be awaited with interest.

Weirs on Native Reserves, etc.—A commencement was made during the year with the construction of weirs for the conservation of surface water in native reserves and native purchase areas. Two weirs were constructed on Raditladi's and Semokwe Reserves, and one weir on the Insiza native purchase area.

The weirs are intended to supplement the existing policy of the development of water supplies by means of boring, and are located in areas where boring has failed to develop adequate supplies. An extension of this policy is, however, necessary, and would result in the general improvement of underground supplies in the reserves.

Boring.—The number of drills in the field was the same as in the previous year, but two drills were temporarily taken out of commission late in the year owing to the restrictions on movements of cattle making it too expensive to transport them from the remote areas in which they were operating.

In addition, three drills were refitted in the field and were temporarily out of commission for periods varying from a month to six weeks, and time was occupied in shifting five other drills long distances to new areas. Making allowances for these facts, the strength was equivalent to 9½ drills working for a complete year.

The summary of footage drilled, cost per foot and aggregate yield of water supplies developed is as under:—

Total depth drilled, 15,967 feet; footage drilled per working month per drill, 140.1 feet; number of boreholes sunk, 116; average depth per borehole, 137.6 feet; average charge (all boreholes), including casing and depreciation in plant, 21s. 7d. per foot; aggregate yield of successful boreholes, 823,600 gallons per 24 hours; percentage of successful boreholes, 60.3 per cent.

In the following detailed summary is shown the cost of drilling for private applicants, Government institutions, native reserves, etc.

In the case of private applicants, transport, labour and fuel are supplied by the applicant, but in other cases these are supplied by the Government, and the cost of these services, together with depreciation on the plant, included in the boring costs.

	Private Applicants.	Government Institutions	Native Reserves.	Native Purchase Areas.	Railways.
Total depth drilled, feet.	4,982	1,337	6,403	2,428	817
No. of drill months.	32	8	42	27	5
Footage drilled per working month per drill.	155.7	167.1	152.5	90.0	163.4
No. of boreholes sunk	39	11	39	21	6
Average depth per borehole, feet.	127.8	121.5	164.2	115.6	136.2
Average cost per foot, including casing.	18/-	24/7	21/11	25/4	24/1
Percentage of successful boreholes.	71.8	36.4	56.4	52.4	66.6

It has, unfortunately, not been possible to maintain the higher standard attained in the previous year and the footage drilled has decreased, with a consequent increase in the cost per foot drilled.

The reasons for this are the reconditioning of three plants and the time and expense involved in shifting five drills to new areas. When these facts are taken into consideration the increase of 1s. 7d. per foot in the general drilling costs is extremely satisfactory, as it includes the cost of two new boilers, a new frame, all transport charges and a balance of £1,154 available for depreciation.

The costs to private applicants show an increase of 3s. 3d. on the previous year's figure, owing to the more difficult formations drilled in and the scattered nature of the work.

The present year's figure of 18s. per foot is, however, practically the average cost, as during the last seven years 25,546 feet have been drilled for private applicants at an average cost of 17s. 10d. per foot.

Water Supplies: Native Reserves.—In addition to the water boring operations and weir construction in the native reserves, windmills, tanks and troughs have been installed at a number of the permanent supplies developed in the various reserves.

Twenty-two complete installations have been erected at an average cost of £150 apiece, and three complete installations are in hand for erection next season.

Meteorology.—The work of the meteorological and hydrographic offices is directly supervised by the Hydrographic Engineer.

The change in the number of reporting stations was as under during the year:—

	Number 31.12.30.	Number 31.12.31.
Stations with automatic instruments	2	3
Barometric	12	10
Thermometric	54	35
Rainfall	530	532
	598	580

A number of stations have been closed down owing to the farms occupied having been temporarily abandoned.

The reduction in the number of thermometric stations is due to the defined policy of only obtaining returns from such stations as can report daily by telegraph.

These daily records are closely examined and compared and doubtful readings challenged, thus resulting in a distinct improvement in the accuracy of the records. It was found that records obtained from the stations over which this control could not be exercised were of little value. Rain gauges are now being issued through the Native Development Department to native instructors in the reserves.

If this experiment proves successful it may be possible to dispose of a number of gauges in areas from which no information is at present available.

Bulawayo Observatory was taken over completely and equipped with a range of recording instruments and a trained observer has been in charge since 1st March.

Mount Nuzi at Stapleford has been equipped with recording instruments and useful information is being collected. We are indebted to the Forestry Division for the running of this station.

It was hoped that it would be possible to equip a number of stations with thermographs this year, but the instruments arrived too late in the season.

Weather Forecasting.—An investigation of the detailed daily maps of last season has indicated that a considerable amount of our rainfall is due to travelling disturbances. The new International Code was introduced in October and a figure included to indicate the time of rain; this has proved useful in investigating and forecasting "fronts." The new code is more cumbersome than the old and the cloud observations are beyond our present observers. A strict comparison of the weather at neighbouring stations has led to the subdivision of the map into ten forecast areas. Forecasts are now issued specially for each area and are stated in terms of probability of rain at any point instead of the old system of area forecasts.

Aviation Meteorology.—It has been necessary to reorganise the office and staff to meet the demands of aircraft. An officer has been stationed at Bulawayo to run the Observatory and to receive weather reports.

One additional man has been appointed at Salisbury. This has made it possible for one official to concentrate on weather maps and forecasting. The organisation for weather reports has been completed and full reports and forecasts were supplied to the first aeroplane in December.

Information Published.—

(a) Annual Report.

(b) Monthly Weather Report in the *Agricultural Journal.*

(c) Weekly Summary of Rainfall.

(d) A daily weather report and forecast during the rainy season.

(e) Daily records of meteorological elements from five stations were forwarded monthly to London.

(f) Summaries of rainfall are forwarded to Poona and Rio de Janeiro.

(g) Mr. Peake contributed a paper to the South African Association for the Advancement of Science on the daily rainfall at Salisbury and Bulawayo.

Aneroid Levels.—A number of enquiries about the use of aneroids were answered and the Kalahari Survey Party was loaned certain instruments. The levels of the main points on the Kalahari Survey were determined in this office.

Hydrography.—The routine work of this section comprises the collection of data relating to storm and winter flow conditions of the chief rivers of the Colony.

The information is obtained by means of:—

(1) Automatic recording instruments at gauging weirs and dams.

(2) Individual gaugings by members of the engineering staff while on tour.

A gauging instrument was erected on the Umshandige River in connection with the survey recently completed there. One station at Glengrey was closed and the number of stations remains as before—13.

Complete records have been calculated for four stations and will be available for publication in this year's report.

Water Ordinance.—The writer, or the Hydrographic Engineer as alternate, sat as engineering assessor on four water courts during the year, one of which was a special court to deal with an application from the Gwelo Municipality.

In all, 44 applications were dealt with, of which ten were for mining purposes, one for town water supply and one for railway purposes, the remainder being for irrigation. Three of the applications were refused, so that in all 29

irrigation schemes were approved, for which authority was sought to irrigate 1,490 acres, and grants actually issued for the irrigation of 1,303 acres.

Staff.—Owing to the recommendations of the Economy Committee one assistant engineer was retrenched towards the end of the year. The staff was practically at full strength throughout the year, with the exception of the Irrigation Engineer (Matabeleland), who was absent on long leave.

Acknowledgment is made of the loyal services rendered by the whole staff of the division during the year.

ANNUAL REPORT OF THE DIVISION OF FORESTRY

FOR THE YEAR 1931.

By E. J. Kelly Edwards, M.A., Dip.For.(Oxon.),
Senior Forest Officer.

TWELFTH ANNUAL REPORT.

Despite adverse conditions, both financial and climatic, the Division of Forestry is able to report satisfactory progress for the year under review. Reduced funds and the need for economy in funds available have restricted operations, while the rainy season 1930-31, which started so well, failed abruptly early in the year and caused many losses to new plantings and sowings. It was therefore to be expected that in order to consolidate the ground previously gained the same expansion recorded for 1930 could not be achieved.

More extensive economies which are foreshadowed for the coming year will still further restrict our activities, but

rather than despair we prefer to regard these setbacks as purely temporary, and with the philosophy of the forester who knows that in spite of all the ills that trees are heir to, they will go on growing.

A sign of the times was the necessity for the establishment in September of a new European unemployment relief camp. With the figures of European labourers at Mtao swelling to 150, and comprising all types of unemployed and unemployables, it was found advisable to start a new camp at Stapleford, where higher rates of wage are obtainable, to relieve the congestion and to act as a promotion camp from Mtao. The Stapleford camp has a fixed capacity of forty men of the type genuinely seeking employment, and which can be recommended as outside employment becomes available. As men leave the camp the fixed number is kept up to strength by drafts from the Mtao camp.

At the end of the year there were 23 men at Stapleford, as accommodation for full capacity had not yet been completed. At Mtao 117 men were employed on the 1st January, 197 men were admitted during the year and 207 left; 107 men were employed at the end of the year. The behaviour of the men at both stations has been satisfactory.

As a result of the recommendations of an Economy Committee afforestation operations are to be considerably reduced during 1932. For the meantime no further plantings are to be undertaken on the Fairfield and Eastfield Patrols at Mtao, which are run by native labour. The necessary maintenance work will, however, be carried out. Operations at Stapleford will continue on a reduced scale.

Valuation surveys and inspections of forest areas on behalf of the Native and Lands Departments have served to confirm previous reports on the rapid forest destruction which is proceeding in certain parts of the Colony. In the Kalahari Sand Areas alone fire losses are truly appalling, and many "teak" forests are rapidly deteriorating to useless scrub. Destruction by natives through the non-regulation of cutting and deliberate firing is also in evidence to such an extent that in places there is already a timber shortage.

It is regretted that it has not yet been possible to institute fire protection in the Ngamo Forest Reserve in the

Wankie district. This reserve, 291,000 acres in extent, lies within an open shooting area where the destruction of game is encouraged to prevent the spread of tsetse fly. Unfortunately valuable Kalahari Sand forest is sharing the fate of the game, and the Forest Service remains powerless to intervene on behalf of the forest where hunters of all types are allowed free access. To attempt fire protection where trespass is untrammelled would be sheer waste of public money.

It is pleasing to record that, although over large areas of the Colony destruction of game is being ruthlessly carried out in connection with tsetse fly operations, in others sanctuary is being given to game in additional game reserves. It is probable that the Kalahari Sand forests owe their survival to the presence at one time of immense herds of game. Observations show that fire destruction on the grand scale is of comparatively recent occurrence, and dates possibly from the advent of the European and the rise in the native population from the end of the last century. The motives underlying game preservation are many, but it may be of interest to repeat the remarks of the Chairman at a general meeting of the Society for the Preservation of the Fauna of the Empire to the effect that "the survival of animal types might have greater value for our descendants than it had for us. We did not know why particular animals existed, but people in the future might be able to find significance in individual types, and it might make all the difference to them that particular types were preserved alive."

I desire to record with pleasure the efficient and loyal service during a trying year of all members of the Forest Service.

1. **State Forests.**—During the year approximately 96,500 acres of unreserved forest were added to the Victoria Falls Game Reserve. Farms Balcarres and Petty's, in extent 31,152 acres, in the Wankie Game Reserve, reverted to Government by exchange and are now included in the Reserve. An area in the Wankie district surrounding and including the Kazuma Pan and 48,745 acres in extent was proclaimed a game reserve. The Forest Nursery, Salisbury, was accurately surveyed and found to be 112.48 acres in extent.

The north-western and southern boundaries of the Gwaai Forest Reserve were demarcated.

At the end of the year the areas of State forests in which operations were being carried out by the Forest Service were as follows:—

Description.	Area on 1st January. Acres.	Additions or Excisions during Year. Acres.	Total Area at 31st Dec. Acres.
(a) Reserved forests ...	666,404	+ 12	666,416
(b) Unreserved forests	192,000	- 96,500	95,500
(c) National Parks and Game Reserves ...	3,521,520	+ 176,397	3,697,917
Totals	4,379,924	+ 79,909	4,459,833

The boundary between the Stapleford Forest Reserve and farm Charity 9,240 yards in length and 1,460 yards of the boundary between farm Walmer and the Reserve were fenced in conjunction with the owners.

2. **General Maintenance.**—New compartments were surveyed and marked on the ground on the Mtao Forest Reserve. The stock maps of this Reserve have now been brought up to date. The continuation of the contour survey of the Stapleford Forest Reserve was considerably impeded by shortage of staff.

Annual plans of operations prepared for all stations were adhered to as far as practicable. On account of bad planting weather and the fact that expenditure is to be considerably decreased the programme of planting and preparation of soil at Mtao was greatly altered.

A strip survey of indigenous tree veld at Mtao revealed an average volume of 232 cubic feet per acre for trees six inches and over d.b.h. Seventy-three per cent. by volume was represented by *Brachystegia randii* and *Berlinea globiflora.*

Sample plot measurements of eucalypts were continued at this station.

A preliminary valuation of the commercial timbers in the Gwaai Forest Reserve was completed. Valuation surveys were also made of 135 square miles of Crown land forest adjacent to the Reserve on behalf of the Lands Department,

and of 500 square miles of Kalahari Sand forest in the Bubi district on behalf of the Native Department.

3. **Protection.**—Regular patrols were carried out on the Stapleford, Mtao and Gwaai Forest Reserves, the Fuller-Kesi unreserved area and in the Wankie and Victoria Falls Game Reserves. During the year thirteen convictions were obtained for forest offences.

The usual but more intensive fire protection operations were carried out on the Stapleford and Mtao Forest Reserves. With the much reduced funds available for protection in the Kalahari Sand forests an attempt was made to protect the same areas as hitherto. Unfortunately intense early fires entered the Gwaai Forest Reserve before the external fire lines had been completed.

The fire protection on the reserves where plantings are in progress was extremely satisfactory. No fires occurred except at Mtao over half an acre of two-year-old *Eucalyptus crebra*, which was slightly damaged.

In the Kalahari Sand areas dry weather conditions resulted in the fire hazard being felt as early as May. Grass growth was unusually rank and fire fighting was attended with great risk.

On account of the absence of staff on seconded duty the amount of damage from fire has not yet been assessed, but provisional figures indicate that in the Masue Section 5 per cent., in the Fuller-Kesi Section 2 per cent. and in the Gwaai Forest Reserve 26 per cent. of the protected area were traversed by fire. This represents 19.3 per cent. of the total of 663 square miles protected.

Experience of fire protection in the Kalahari Sands indicates that rigid and prolonged intensive protection of wide areas is difficult and costly to achieve. Time may yet show that it is not even desirable. Methods of passing light fires through the forest at the right time of the year and of burning poor forest to safeguard groups of better quality are being evolved. If forest can be carried through the sapling and pole stages free from fire damage the main difficulty will be solved. Occasional subsequent fires may do little or no harm, provided they are not too frequent.

A system of classifying fires by the amount of damage done to the several component parts of a forest is being adopted. By this means a truer assessment of losses will be obtained and the technique of fire protection will be considerably improved. Whatever the system of protection adopted in this Colony, the key to success is adequate European supervision.

The damage from field rats at Stapleford was considerably greater than in previous years. *Cupressus lusitanica* was particularly favoured for attack, and pines were not left untouched. To cope with the evil heavy weeding has been undertaken. Experiments carried out with a rat virus have given negative results, but further trial is needed.

No frost damage was reported during the year.

The effects of drought during and after the rainy season were again evident throughout the Colony, particularly in young plantations. It is the incidence rather than the amount of rainfall which is of such vital importance to the establishment of plantations. Long periods of hot sunny weather following otherwise adequate precipitation were the cause of many setbacks during the past planting season.

4. **Silviculture.**—(a) *Natural Reproduction.*—The oft-recorded reproductive capacity of indigenous trees from stool and seed is again mentioned, and opportunity is taken to pay tribute to nature for her success against the persistent destructive efforts of frost, fire and man. Nevertheless, the combined efforts of 1,100,000 inhabitants aided by frost and fire are causing serious depletion of forest resources in certain areas, and the time has already arrived for more attention to be paid to the conservation of our forests generally.

Very heavy germination of seed was noted under nine-year-old eucalypts at Mtao. The seedlings, however, died off from exposure. No steps were taken to foster them, as regeneration was not sought.

(b) *Artificial Reproduction.*—Further evidence of the good results obtained from introducing mycorhiza to new pine soils was obtained. At Macheke, an area typical of the plateau sand veld, several rows of *Pinus insignis* in an unthrifty plantation were treated with inoculated soil. The treated plants, now two years old, have assumed the

characteristic healthy colour of the species and average two feet in height. The untreated plants continue in their stunted state. Blankings from an inoculated nursery are making good growth. It is worthy of note that at Mtao untreated pines after five years of meagre growth are now growing apace.

The afforestation operations carried out during the year were as follows:—

Station.	Total Area Afforested 31.12.30. Acres.	Area Afforested 1931. Acres.	Total Area Afforested 31.12.31. Acres.
Forest Nursery, Salisbury	36.50	—	36.50
Mtao Forest Reserve	1,448.87	205.00	1,653.87
Stapleford Forest Reserve	1,820.16	682.32	2,502.48
Totals	3,305.53	887.32	4,192.85

The areas for 1930 at Mtao and Stapleford have been reduced by survey adjustments and failures in certain *in situ* sown areas.

Heavy blankings were necessary at Stapleford and Mtao on account of drought, unfavourable planting weather, the failure of sown areas and damage by rodents. Weeding costs at Stapleford were considerably in excess of previous years, partly on account of the nature of the localities treated and partly to check rat infestations.

(c) *Interplanting of Indigenous Forests with Exotics.*—During the period 1924-26 extensive interplanting operations were carried out at Mtao with the objects of introducing a cheap method of afforestation by avoiding heavy stumping and clearing costs, and augmenting the yield of timber. The indigenous forest consisted of *Brachystegia randii* (msasa) and *Berlinea globiflora* (mnondo) tree-veld, with such associates as *Parinarium mobola* (muhatja), *Burkea africana* (mukarati), *Pterocarpus angolensis* (bloodwood), *Monotes glaber* (muwara), *Faurea saligna* (musasati), *Terminalia sericea* (mukonono), etc.

Strips three feet wide and six feet to twelve feet apart were hoed in the natural forest after a minimum amount of

clearing had been carried out. Thereafter 92 acres were interplanted with conifers and 140 acres with eucalypts.

For some years the results obtained were discouraging. Growth was extremely slow, due possibly to some toxic action of the msasa or to excessive root competition. Except in isolated cases under and near muhatja the growth of interplanted trees compared very unfavourably with that of the same species planted in completely cleared areas. In 1930 it was noted that better growth was being achieved, and in 1931 many of the interplanted species were definitely in the ascendant. Of particular interest is the fact that conifers such as *Callitris calcarata*, *C. glauca*, *Pinus insignis* and *P. pinaster* are now making rapid growth.

Although interplantings have been discontinued since 1926, on account of the slow initial growth, the experience gained indicates the possibility of augmenting poorly stocked hardwood forests with suitable softwoods and also with fast growing exotic hardwoods.

(d) *Nurseries and Sales of Seeds and Transplants.*—The abrupt failure of the rains in the middle of February caused a considerable decline in the revenue of the Salisbury Forest Nursery. There were 910 visitors to this nursery during the year. New nurseries were established at Stapleford and at the European relief camp, Mtao. For the ensuing year all plants for the Mtao Forest Reserve will be raised by the European labourers. During the year 5,188,500 transplants and seedlings were raised at all nurseries and 2,419,550 distributed, sold and planted.

(e) *Trial of New Species.*—The arboreta on all forest reserves were extended, particularly at Stapleford and in the Kalahari Sand areas.

Experimental plantings of the tung oil tree (*Aleurites fordii*) carried out by farmers in many parts of the Colony are showing promise. In Salisbury an individual tree flowered and fruited at four years of age. Another tree of the same age was severely scorched by a grass fire, but recovered completely during the present rainy season.

5. **Exploitation.**—Departmental exploitation was confined to utilising small quantities of indigenous timber and poles from plantations for local needs on the reserves for buildings and furniture, bridges and fencing.

Messrs. Rhodesian Native Timber Concessions and Zambesi Sawmills, Limited, continued exploitation of forests in the Kalahari Sand areas under concessions from the Department of Lands, to whom royalty is paid. The chief timbers exploited are "Rhodesian teak" (*Baikiæa plurijuga*), umtjibi (*Copaifera coleosperma*), bloodwood (*Pterocarpus angolensis*) and mugongo (*Ricinodendron rautanenii*).

In the Lomagundi district *Khaya nyasica*, so-called "Banket mahogany," is being exploited in a small way for furniture, panelling, etc.

6. **Roads, Communications and Buildings.**—At Stapleford 1,200 yards of branch road from the main reserve road were made to the new European labour camp. 8,760 yards of bridle paths were constructed.

At the European relief camp a two-roomed hut with lean-to kitchen for the Forester and a mess hall for the men were built with wattle and daub. Twenty rooms in blocks of four, a kitchen and store, all of tarred kimberley brick, were constructed for the European labourers.

On the Mtao Forest Reserve one and a half miles of new road were completed, and the fire telephone system extended along this road. New buildings comprised a hut at Fairfield and six huts at the new European labour nursery.

All reserve roads and buildings were kept in repair.

7. **Live Stock.**—The live stock on hand at the end of the year for all stations totalled 182 oxen, 18 mules, 7 horses and 19 donkeys.

8. **Revenue.**—The revenue (unaudited) for the year, including free issues and excluding timber royalties paid to the Department of Lands, was £1,763 7s. 6d., compared with £2,322 0s. 10d. for the previous year.

9. **Expenditure.**—Expenditure (unaudited) for the year, apart from salaries, allowances, travelling and transport of permanent staff, was:—

	1931.			1930.		
Afforestation and protection	£6,325	9	7	£8,564	5	9
European relief employment	12,522	12	6	8,455	0	10
Total	£18,848	2	1	£17,019	6	7

In April a method of assessing the value of afforestation operations by European relief labour on a native labour basis was instituted in order to give a truer indication of the cost of forestry to the State.

10. **Administration.**—The staff of the Forest Service, exclusive of temporary labour, at the end of the year, consisted of 1 Senior Forest Officer, 4 District Forest Officers, 1 manager (Forest Nursery), 6 foresters, 1 game warden, 2 foremen, 4 apprentices and 1 clerk.

11. **Private Forests.**—During the year only twenty-one private properties were visited officially by officers of this Division. The growing responsibilities on the reserves, the shortage of staff at head office and the need to exercise economy in travelling expenses resulted in much less itinerant advisory duties than in previous years. While existing economic conditions prevail this cannot be remedied. It is nevertheless regretted that so much advice has to be given through the medium of correspondence, which must often be in general terms instead of the definite observations which would result from a field inspection.

The areas under private plantations have shown a remarkable increase in recent years. Available statistics give the following acreages: 1927-28, 8,605 acres; 1928-29, 13,791 acres; and 1929-30, 17,858 acres.

12. **National Parks and Game Reserves.**—No steps were taken to patrol or otherwise supervise the Matopo National Park on account of the lack of funds. The area of the Victoria Falls Game Reserve was considerably extended by the addition in October of 96,500 acres of Kalahari Sand forest. It is hoped that by strict protection game will soon return to this area, whence they have been driven by timber exploitation during the past few years.

The Kazuma Pan Game Reserve was proclaimed in October to deter excessive poaching along the Bechuanaland border. This area will be patrolled by the Victoria Falls game warden.

Wankie Game Reserve: *Patrols.*—During the year all boundaries of the Reserve were regularly patrolled by native rangers, except, on account of lack of water, the southern

portion of the western and the western portion of the southern boundaries. All water supplies were visited regularly. The game warden accomplished 800 miles of ordinary patrol and 1,500 miles of special patrol.

Elephant Control.—The existence of an open shooting area along the major portion of the eastern boundary necessitated the restriction of the movements of elephant into the danger zone. Many small herds were successfully prevented from leaving the reserve, but in July, when water became scarce, it became both impossible and dangerous to check the animals.

Water Supplies.—A water supply near Nyamandhlovu Pan was opened up by digging in May. On account of the fine sand and the frequent visits of game, it was necessary to re-open the supply weekly. On Balcarres an artificial pan was created and water led in a 100-yard concrete furrow from a windmill. The pan was lined with clay and was sufficiently water-tight to be kept full, although over 1,000 gallons were taken weekly by game.

During the major portion of the year the water supply was approximately half that of a normal year. Pans began to dry as early as May, and by November, when rains fell, all but eight had failed.

Salt Licks.—Almost every species of game visits the various salt licks at one time or another, and these salt deposits appear to have a direct bearing on the movement of game and concentration in various parts of the reserve. All licks are frequented during the winter and the hot weather preceding the first rains. During the spring the licks are not visited, and only to a small extent during the rains.

Game.—During the rains elephant frequent the sinanga country (*Acacia giraffæ* and *Acacia* spp.); thereafter their movements are regulated by availability of water. In spring msasa and mfuti forest is preferred for the new foliage, and again in winter when the seed pods are ripening. Many animals left the reserve for water after July and suffered heavy losses from trap-guns and hunters in the open shooting area. Calves are mostly born in August. Some very fine tuskers were seen in the north of the reserve in July. Rogues

caused much trouble in that locality, and one made a very determined attack on the game warden.

The number of giraffe found in the teak forests increases from March to July. From then onwards they gradually move into the sinanga, where they remain until the end of the rains. The young are born in the winter months, though it is not uncommon to find young animals six months old in June.

The majority of eland calves are born in June and July, at which time the herds are very scattered and seldom contain more than 20. From August to October the herds begin to bunch, so that numbers of 500 in a herd are not uncommon. By the middle of November the calves begin to form small herds and, accompanied by a few old cows, separate from the main herd. From February to October the bulls run alone and usually frequent the sinanga. The large herds break up about January, each herd being accompanied by a bull.

Oryx are seen frequently at all times of the year and mostly in Kalahari Sand forest. Before the advent of the rains the herds appear to bunch and frequently change locality in search of grazing rather than water, for they can apparently dispense with water for months at a stretch.

Wildebeeste, sable and roan are much affected by drought, as they are grazers rather than browsers. Several sable were found dead in October from poverty.

Vermin shot during the year comprised 12 lions, 6 leopards, 29 hyæna and 3 wild dogs. Lions and leopards are not particularly troublesome, but hyænas and wild dogs caused much damage.

Game Catching.—During the year a young giraffe was captured and presented to the Pretoria Zoo. The game warden accompanied the animal by train and spent some days at the zoo in studying the management and care of animals in captivity.

13. **General.**—*Trout Acclimatisation.*—The trout at Stapleford continue to thrive, and during the year a fine specimen measuring 14 inches and weighing 1½ lbs. was caught and presented to the museum in Salisbury. In

August a further supply of 7,500 ova was obtained from the Umtali branch of the Angling Society and hatched in two hatching boxes. The fry were then liberated in the Odzani River.

Publications.—The publications during the year, excluding an article in the press, were:—

(1) "The Camelthorn (*Acacia giraffæ*, Burch)," by J. S. Henkel, F.R.S.(S.Af.); (2) "Establishing Pines—Preliminary Observations on the Effects of Soil Inoculation," issued by the Division of Forestry; (3) "The Raising of Forest Seedlings and Transplants on the Farm," by E. J. Kelly Edwards, M.A., Dip.For.(Oxon.); (4) "The Woodland Types of Southern Rhodesia," in two parts, by J. S. Henkel, F.R.S.(S.Af.)—the foregoing appeared in the *Rhodesia Agricultural Journal;* (5) "Provisional Map of the Types of Vegetation in Southern Rhodesia" (coloured, scales 16 miles to an inch and 32 miles to an inch), by J. S. Henkel, Surveyor General's Office, Salisbury; (6) "Types of Vegetation in Southern Rhodesia," by J. S. Henkel, Dip.For., F.R.S.(S.Af.)—Proceedings of the Rhodesia Scientific Association, Vol. XXX., 1931.

THE EIGHTH ANNUAL MAIZE GRADING AND EXPORT CONFERENCE.

The eighth Maize Grading and Export Conference was held this year on the 19th April in the offices of the Department of Agriculture, and was attended by the following: Messrs. Jacklin (Chairman, Maize Control Board), Garmany (Maize Control Board), J. Buckmaster (Farmers' Co-operative Society and Maize Control Board), Worthington-Reid (Gwelo Maize Pool), McLeod (Fort Victoria Farmers' Co-operative Society), Parker (Maize Association), W. Rogers (Dreyfus and Co.), G. L. Robertson (District Superintendent of Transportation, Rhodesia Railways), together with

the Chief, Division of Plant Industry, the Assistant Agriculturist and the Senior Grain Inspector.

The chair was taken by the Chief, Division of Plant Industry, who, after welcoming the delegates, summarised the results of the enquiries and investigations undertaken by the Department of Agriculture at the request of the previous Conference, and which had already been reported upon in full in the *Rhodesia Agricultural Journal* or in the local press.

Amongst other matters dealt with, the following of general interest to farmers may be recorded:—

1. **Matters arising out of Resolutions adopted at the last Conference.**—Mr. Buckmaster recorded appreciation on behalf of the members of the Farmers' Co-operative Society of the valuable advice in regard to harvesting methods which had been issued during the year by the Division of Plant Industry. The Hon. John Parker suggested that it would be advisable to republish past advice to refresh the memories of growers and to remind them of the many difficulties experienced in past seasons in presenting dry maize bagged in acceptable condition for export, particularly having in mind the late drying conditions of the present season. Mr. Worthington-Reid thought it was now largely a question of farm discipline; he considered that experienced growers could protect their own interests, but he appealed for further Departmental contact with growers in the Gwelo and Fort Victoria areas, which had not previous to last season participated in export overseas. He recommended a summary of past advice in draft under a covering letter for distribution to associations in those areas.

2. **Maize Grading Staff.**—This item, introduced by Mr. Jacklin, was discussed at considerable length and by all delegates. Mr. Jacklin stressed the desirability of economy in regard to the handling of maize, and the importance of loading direct into trucks wherever possible. He considered that at points where stacking space was limited, special consideration should be given to applications for farm grading, provided that consignments were reasonably large ones. He further emphasised the importance of the availability of graders as and when required, and was of the opinion that a reduction in the number of graders on last

year's strength would place his Board in difficulties this season in view of the larger export anticipated.

Mr. Buckmaster considered it impossible for the Board's checkers to receive, grade and load maize during the early part of the export season, but thought the privilege of grading their own maize might be applied in special cases or urgent demands and rushes. He recorded his appreciation of the grading duties as performed by the Government graders last season.

The desirability of employing permanent and experienced graders was vigorously voiced, and after much discussion the number of graders required for the coming export season was agreed upon in terms of the following resolution, which was passed unanimously:—

> "That in view of the large maize crop anticipated this season and the considerable export to be expected, this Conference considers it essential that a nucleus of at least four experienced graders should be maintained from the end of June onwards, assisted by such additional temporary graders as circumstances demand."

3. **Transport of Graders.**—The Conference again stressed the necessity of adequate motor transport for graders and their equipment, particularly in view of a further restricted train service on the branch lines.

4. **Quality of Maize.**—A further appeal was made by the Gwelo and Fort Victoria delegates, who urged the importance of tuition and advice being given in their areas, where export is still in its infancy. Last year's experience was cited of a depot which was literally nothing more than a "drying out" station instead of an export depot.

One delegate was of the opinion that native maize was improving in quality and that in certain areas European maize was deteriorating in quality. It was stated that a higher grade of maize was now required for conversion into meal than in the past, and that it was incumbent on growers to ensure that their maize was free of chaff, dirt, broken grain and diplodia infected grains. If attention was not paid to this, millers would buy the best native maize in preference to the inferior European grown article.

The smaller shelling outfits were criticised for the excess of chaff and undesirable grain contained in many samples, due to an insufficient "blast" and to improper screening; these, together with the shelling of maize in too damp a condition and the running of machines at incorrect speeds, were the primary causes of inferior quality in the bagged product. The undesirable presence of diplodia infected grain was attributed to carelessness on the part of the farmer in not eliminating diseased cobs at the time of threshing.

5. **Pigeon-hole Stacking.**—Mr. Buckmaster informed the Conference that this method of restacking wet maize in accordance with the recommendations of the Department of Agriculture had proved very satisfactory in all instances where it had been used last season, but the limited space at many sidings and stations rendered the adoption of the system impossible on any extensive scale. He considered it highly desirable that the practice should be encouraged on farms, and that farmers in fear of over-moist maize should stack their bags direct from the sheller. The following resolution was moved and carried:—

> "That the Department of Agriculture take immediate steps to call the attention of maize growers to the efficiency of pigeon-hole stacking and to the advantages of adopting this system on the farm immediately after shelling, with the object of ensuring an accelerated drying out of the maize during the interval between shelling and transportation to the railway."

Mr. Garmany emphasised the unnecessary risk and cost of insurance against fire when the bags are stacked on maize husks (envelopes), and recommended the more general use of "cobs," poles and second hand railway sleepers, since these caused little risk of fire and provided better protection against white ants and soil moisture.

PIGEON-HOLE METHOD OF STACKING MAIZE.

(Bulletin No. 822, Revised.)

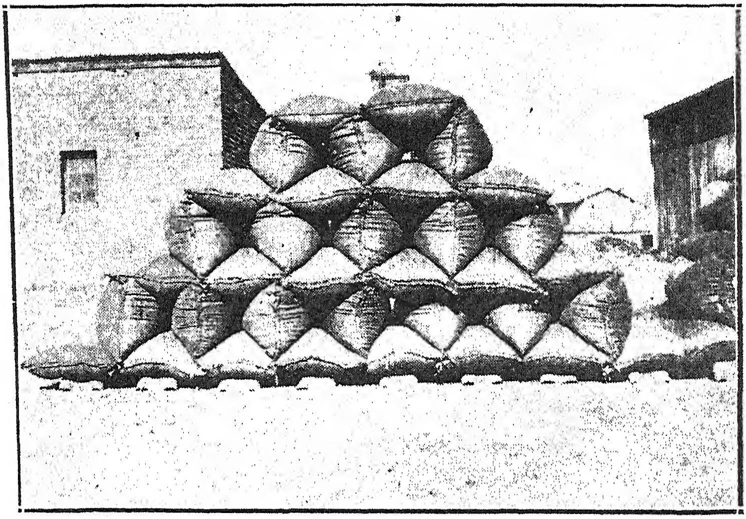
By the Division of Plant Industry.

At the eighth Maize Grading and Export Conference recently held in Salisbury stress was laid by various delegates on the advantages of applying the pigeon-hole method of stacking to maize on the farm, direct from the sheller, as compared with the same method when employed at stations or sidings for maize temporarily rejected for export on account of excessive moisture. It was recommended that the Department of Agriculture republish at the earliest possible date the information contained in Bulletin No. 822 together with the illustration.

The original recommendations for restacking were made mainly in respect of maize delivered to stations and sidings and later found by the graders to be excessively wet. It is now found that at certain points on the railway line space is a limiting factor and that this method of restacking maize can only therefore be employed in certain circumstances, and even so at considerable inconvenience and expense to the farmer.

In order to keep down costs to a minimum and to ensure that maize is delivered in the driest possible condition for export, it is now recommended that wherever there is the least doubt as to the dryness of the maize the pigeon-hole method of stacking should be adopted on the farm, where space is of little consideration, where dunnage is plentiful and cheap and where the maize can be thus stacked direct from the sheller, so affording it the greatest possible opportunity to dry out during the interval between the shelling and transportation to rail head.

The farmer who has taken all the necessary precautions against wet maize when harvesting and who is satisfied that his grain does not contain more than 12.5 per cent. moisture, will naturally not need to adopt this system of stacking. On the other hand rather than run the risk of having his maize rejected on the railway line and then being required to pigeon-hole stack, or wait at least three weeks before it is re-examined, he will be well advised to stack in this manner on the farm in the first instance.



The method of pigeon-hole stacking recommended.

The method of pigeon-hole stacking recommended is as follows:—

Vide illustration: The bottom layer of bags are laid on the dunnage on their broader sides, and the next tier is placed with their narrower sides resting in the depressions which occur where the bags in the lower layer meet each other. The third tier is arranged similarly to the first, and so on until the stack is five or seven tiers—no more—in height.

Bagged maize stacked during the dry winter months under the above system dries out more rapidly than under any other system so far devised. An instance of this may

be quoted. Last season a certain consignment stacked in the usual manner—i.e., block stacked—was rejected on account of excessive moisture. It was left for two months, and even at the end of that time still contained 12.9 per cent. of moisture. It was then restacked on the pigeon-hole system and in seven days had dried out sufficiently to pass the test.

Should any portion of the crop already delivered to the railway line be found to be excessively moist, growers are advised to discontinue riding to the railway until they have submitted a representative sample of the remainder of the grain for moisture test, and have, if necessary, pigeon-hole stacked the undelivered balance of the crop on the farm.

Restacking either on the farm or on the railway cannot but entail considerable added expense, and the remedy for the need of such measures lies in the grower ensuring that the wettest of his grain is dried out to within at the utmost .2 per cent. of the maximum permitted for export before he commences delivery to the railway line.

Much, if not all, of the difficulty experienced in regard to over-moist maize can be overcome by the grower exercising greater supervision when harvesting, and by learning to judge the moisture content more accurately. This last can be achieved by submitting samples to the Department of Agriculture for test and by retaining on the farm in a similar air-tight receptacle a part of the sample for comparison when the result of the test is communicated.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

ANNUAL REPORT OF EXPERIMENTS, 1930-31.

Part I.

By H. C. Arnold, Station Manager.

Published with the authority of the Chief, Division of Plant Industry.

During the season under review the total rainfall at this station was 31.47 inches, which almost equals the mean annual precipitation, but of this total 26.21 inches fell between the 1st December and the 8th February, after which date only one shower exceeding half an inch was recorded. The intervals between the other showers were so prolonged as to render them almost valueless. It will be realised, therefore, that while the rainfall exceeded requirements during the early part of the season, the lack of rain during the critical grain development period may be assumed to have reduced the yields considerably. The rainfall for the period 9th February to the 31st March was the lowest recorded for several years.

Analysis of Rainfall, Season 1930-31.

Month.	No. of rain days.	Total for month.	No. of rains over $\frac{1}{4}$ inch.	Total to end of month.	Periods exceeding 1 week without rain.
October	—	Nil.	—	Nil.	—
November ...	6	2.63	3	2.63	Nil.
December ...	23	11.09	10	13.72	Nil.
January	18	10.14	8	23.86	Nil.
February	11	6.02	9	29.88	Feb. 22-Mar. 2.
March	6	1.11	2	30.99	Mar. 3 to 8.
April	3	0.48	1	31.47	Mar. 18 to 30.
	67	31.47	33	—	3 periods of 7 days or over.

The results of experiments conducted at this station since 1919-20 are available for reference in bulletin form, and to facilitate comparison this report is framed on similar lines to previous ones.

Having served their purpose, the following experiments have been discontinued:—

1. Maize planted on the previous season's tobacco ridges without ploughing the land.

2. Maize following green manures ploughed under early *versus* ploughed under late.

3. Maize distance-planting trials for grain.

4. Canna distance-planting trials.

5. Canna *versus* sweet potato trials.

New investigations commenced include:—

1. Maize in widely spaced rows with and without a leguminous crop between the rows *versus* the usual planting of 36 ins. x 18 ins.

2. Comparison on the yield of maize of lime *versus* raw rock phosphate of equal cash value, when applied in addition to a basal dressing of superphosphate and potash.

3. Comparison of the effects of burning a crop of sunn hemp on the land, with that of an application of a like amount of the same ash burnt elsewhere, compared with the ploughing under of the entire crop as a green manure.

CROP ROTATION EXPERIMENTS.

FIRST SERIES, 1913-31.

Maize Yields in Bags per Acre.

System of cropping.	1930-31: Rainfall, 31.47 inches.	1929-30: Rainfall, 23.46 inches.	1928-29: Rainfall, 31.62 inches.	1927-28: Rainfall, 26.63 inches.	1926-27: Rainfall, 22.39 inches.	Average yields.
*A1. Maize continuous green manured, plus 250 lbs. per acre bone meal and 19 per cent. supers in 1928-29 (17th year)	12.60	15.88	Green manure ploughed under.	1.90	5.25	...
*A2. Maize continuous, 250 lbs. per acre bone and supers to the maize in 1928-29 (17th year)	2.99	11.44	6.20	...	...	...
†B. Alternate maize and bare summer fallow; no manure or fertiliser	1.95	6.43	5.65	8.15	10.20	10.05
C. Three-course rotation: maize, velvet beans (reaped), oats; no manure or fertiliser ...	11.70	11.36	12.00	12.15	16.90	14.78
D. Four-course rotation: maize (plus 6 tons dung per acre), oats, velvet beans (reaped), maize; average of 2 maize plots	14.93	15.79	19.00	17.45	23.45	...
Maize (no manure direct)	14.95	13.25	21.35	14.10	24.80	18.31 (15 years)
Maize (dunged plots) ...	14.90	18.33	16.65	20.80	22.05	19.56

* Note.—Having grown maize for 15 years in succession without manure or fertiliser, during which time its yields had gradually decreased until they had become so low as under practical field conditions to have rendered them negligible, this plot had served its purpose. With the object of comparing two methods of again raising the cropping power of such land to a more profitable standard, the whole plot was treated with a mixture of one-third bone meal and two-thirds superphosphate, at the rate of 250 lbs. per acre, at the beginning of the 1928-29 season. One half of the plot was then planted to maize, while the other half was sown to a mixture of Sunn hemp and velvet beans, which were subsequently ploughed in.

† In 1929-30 this system was amended from "Alternate maize and bare summer fallow" to "Alternate maize and dolichos beans for hay."

The beneficial effect of green manuring is once again clearly shown by the yields of the A plots. During the three seasons 1929-31 the A2 plot (which received fertiliser only) has yielded a total of 20.63 bags per acre, whereas in the same period on the A1 plots the *two* maize crops following the ploughing under of green manure have yielded 28.48 bags. The green manuring has therefore added nearly 8 bags of maize to the yield and a further slight economy has been effected by reason of there being only two heavy crops to handle instead of three light ones. No more important experimental result than this has been recorded in the history of Rhodesian experiment stations, and the conclusion arrived at is fortunately confirmed by the experience of a number of practical farmers. The renovation of worn-out land is usually a lengthy and expensive process, and the knowledge that a soil so exhausted by constant cropping as to be incapable of producing two bags of maize an acre, by one green manuring and the use of 200-300 lbs. of artificial fertilisers costing perhaps £1 per acre, can be restored to an economic state of fertility in one season is, as far as is known, almost without parallel elsewhere.

System B.—When comparing the tabulated yields for this rotation, it must be remembered that they are for a two-year period, whilst those for the A plots are annual yields. The former show that after cropping the land to maize with bare fallow in alternate seasons, over a period of 15 years, its crop-producing ability remained greater than that of the A plots before they received fertiliser treatment. The only advantage over continuous annual cropping has been that gained through the economy of handling heavier crops on a smaller area. This experiment has conclusively shown that the bare summer fallow is not an effective and economic factor in the management of arable land in Rhodesia.

Having demonstrated that bare fallowing is not beneficial, this experiment has served its purpose and last season it was decided to introduce dolichos beans for hay in place of the bare fallow. The soil, however, was so depleted in fertility that the growth of the dolichos beans that season was exceedingly poor and no benefit from the change can be indicated in this report.

System C.—In this case the land is cropped every year, and although it carries maize but once in each three-year period, the yields are so much higher than those in system B as to clearly show that maize may be produced more economically when grown in rotation with other crops than in alternation with fallow. Except for the ploughing under of the dry crop residues, no manure or fertiliser has been applied to this land at any time during the past 18 years.

System D.—Although the dressing of farmyard manure applied in this system is comparatively small, the yields are being well maintained. Not only are the maize crops heavier than in rotation C, but the oat and bean crops are also much more luxuriant.

A comparison of the original four methods of cropping adopted in these experiments very strikingly exemplifies the economy of soil fertility which is effected by a suitable rotation of crops, and the increased yields which follow when rotation is combined with the use of even small amounts of farm manure.

Second Series of Crop Rotations.

These rotations were laid down in 1919-20 and were designed to evolve a system of cropping which would meet the needs of farmers who could not adopt mixed farming. The series includes two plots, A and F, on which maize was grown continuously for ten years without manure or fertiliser to serve as checks on the results from the rotations. For this purpose the cropping of plot A continues as in the past, but on plot F, commencing last season, fertiliser is applied in alternate years. The fertiliser treatment given to this plot is the same in quality and quantity as that accorded in rotational system H, but green manuring is entirely omitted.

Plot A, System E.

Maize continuous without manure or fertiliser.

Seasons and Yields of Maize in Bags per Acre.

1930-31.	1929-30.	1928-29.	1927-28.	1926-27.	1925-26.	Average over 12 years.
2.33	7.85	7.65	6.5	10.6	12.0	11.39

Plots B to E, System F.

Three quarters of the land under maize, one-quarter under Sudan grass. Each year one section under maize, commencing with Plot B in 1919-20, receives eight tons of farm manure per acre, and commencing on Plot E in 1929-30, the section which grew Sudan grass the previous season receiving 200 lbs. per acre of superphosphate (19 per cent. P_2O_5).

Maize Yields in Bags per Acre.

	1930-31.	1929-30.	1928-29.	1927-28.	1926-27.	1919-20.	Average, 1920-31.
Plot B	9.10†	Sudan g.	14.55	17.00*	18.15	26.0	18.21
Plot C	Sudan g.	13.33	10.15*	8.50	Sudan g.	23.0	15.40
Plot D	9.10	15.78*	9.55	Sudan g.	16.25	Sudan g.	17.02
Plot E	13.42*	13.90†	Sudan g.	11.60	20.30*	24.6	16.36
Average	10.54	14.34	11.42	12.36	18.27	24.7	16.75

* Indicates the application of farmyard manure.
† Indicates the application of 200 lbs. per acre superphosphate.

The beneficial effect of an application of farmyard manure is very clearly shown by this experiment, but the reason for the comparatively low yield of 9.10 bags per acre following a dressing of 200 lbs. per acre superphosphate is not yet apparent. The lack of humus in the soil, combined with an unfavourable season, may probably be the chief causes. The average yield of the plots during 1930-31, it will be noted, is nearly four bags per acre less than that for the previous year.

Plot F, System G.

Maize continuous. No manure or fertiliser during the first ten years. Commencing season 1929-30, fertiliser consisting of one-third bone meal and two-thirds superphosphate at the rate of 200 lbs. per acre is applied every alternate year.

Seasons and Yields of Maize in Bags per Acre.

1930-31.	1929-30.	1928-29.	1927-28.	1920-21.	1919-20.	Average over 12 years.
7.03	6.38*	6.1	4.8	24.2	23.3	11.37

* Indicates the application of 200 lbs. per acre superphosphate.

Fertiliser of the same kind and in the same quantities is applied to this plot as in System H below, but in this case no humus, either in the form of farmyard or green manure, is given. In this way information regarding the practicability or otherwise of profitable maize production on soil lacking humus though amply supplied with phosphates should be provided.

In spite of the unfavourable weather conditions, a somewhat heavier yield of maize was reaped on this plot during the season under review than in the previous season when a direct application of fertiliser was made. This corroborates the results obtained on System A in the first series of rotation trials. It has already been noted that unfavourable weather conditions appear to have reduced the yield in System F this season, by approximately four bags per acre; if this amount is added to the seven actually reaped in System G, the results are strikingly similar to those obtained in System A, viz., six bags in the season of application and eleven bags in the following season. It appears probable that when the fertility of the land has become much reduced by repeated cropping to maize, the humus and nitrogen content of the soil is so depleted as to prevent immediate use being made of the phosphate. But the increased root development of the fertilised crop adds some humus, and probably increases the population of nitrifying bacteria, so that in the second year, the humus and nitrogen having to some extent increased, larger use can be made of the phosphate residue in the soil.

Plots G to K, System H.

Three-quarters of the land under maize, one quarter under velvet beans, which are ploughed under for green manure. From the commencement of the experiment until 1928-29 this land received one green manuring and one application of fertiliser during each period of four years. The returns from these plots showed that insufficient plant food had been supplied to maintain fertility, and the manurial system was then amended to provide for two dressings of fertiliser during each four-year period. The crop of maize which follows the green manuring now receives 200 lbs. of 19 per cent. superphosphate per acre, which should enable it to make better use of the nitrogen supplied by the green manure; the second maize crop receives no fertiliser, and the third crop—that immediately in front of the green crop—receives 200 lbs. per acre of a mixture of bone meal and superphosphate. Under the revised system it is anticipated that heavier green manure crops will be available for ploughing under, and this combined with the additional application of artificials should result in a satisfactory maintenance of soil fertility.

Plate No. 1.
First Series of Rotations, Plot A and B, 1931.—In background on right: Plot A—maize after fertiliser plus green manuring. In foreground: Plot A—maize after fertiliser without green manuring. Left background: System B—maize following dolichos beans reaped for hay.

Plate No. 2.
First Series of Rotations.—Maize in System C sown 29th November, 1930. Photo taken 31st January, 1931. Compare with maize in foreground and on left of Plate No. 1. The beneficial effect of crop rotation is very evident.

Method of Cultivation Trials.—Foreground: Maize on weedy, uncultivated land. Note the unhealthy light yellow colour of the plants compared with that of the maize in the background, which has received the same treatment except that it has been properly cultivated to kill the weeds.

Method of Application of Fertiliser Trials.—Left foreground: Fertiliser broadcasted and harrowed in a few days before planting seed. Right foreground: Fertiliser applied in the seed holes. Background: Fertiliser applied in the drills at planting time. The forcing effect of the two last methods of application is well demonstrated.

Yields of Maize in Bags per Acre.

	1930-31.	1929-30.	1928-29.	1927-28.	1926-27.	1919-20.	Average, 1920-31.
Plot G	16.80*	Beans	8.75	14.50*	17.90	23.10*	15.99
Plot H	Beans.	10.70*	9.00	14.40	Beans.	23.00	15.56
Plot J	6.10*	7.57	17.50	Beans.	14.20	Beans.	15.07
Plot K	7.53	16.00*	Beans.	7.80	14.70*	19.20	14.51
Average	10.14	11.42	11.75	12.23	15.60	21.70	15.28

* Indicates application of fertiliser.

Previous seasons' results are again corroborated in this rotation, and further support is given to the conclusions drawn from Systems F and A in showing that disappointing results follow the application of phosphatic fertiliser to land poor in humus. The tabulation shows that Plot J yielded 17.5 bags per acre in 1928-29, after being green manured in the previous season, but in spite of the application of 200 lbs. of bone and super this season only 6.1 bags per acre were obtained, as compared with 16.80 bags per acre from Plot G, which benefited by both green manure and fertiliser.

These rotation experiments all support each other in showing that results following applications of phosphates to soils lacking in humus are almost invariably disappointing. The failure of the crop to respond to fertiliser is more marked in seasons when climatic conditions are unfavourable, but apart from the fact that it is impossible to foretell whether a season will be favourable or otherwise, the maintenance of an adequate supply of humus in the land should be regarded as a matter of first importance.

Fertiliser and Green Manure Trials.—This experiment was commenced in 1928-29 to determine whether it is more profitable to apply fertiliser to a green manure crop which is to be followed by maize, or to apply the fertiliser direct to the maize crop after ploughing under an unfertilised green manure crop.

The plots on which these experiments are carried out had previously been used for fertiliser trials with maize. Some were of average fertility after having received moderate dressings of fertiliser, but the productive capacity of others had been much reduced by constant cropping without the addition of manure of any kind. Thus the two methods of applying fertiliser are being tried out on land of moderate

fertility as well as on land of low fertility. On half of the plots raw phosphate rock is used, and on the other half a mixture of one-third bone meal and two-thirds superphosphate; in each case the fertiliser is applied at the rate of 200 lbs. per acre.

In the tabulation below, the four plots which gave the lowest yields during the season preceding the commencement of these trials are grouped separately from the remaining four higher yielding plots in each class, in order that comparison of the effects of treatment may be facilitated.

Yields of Maize in Bags per Acre.

	Fertiliser applied to green manure crop.			Fertiliser applied direct to maize (after green manure).		
	Season 1927-28 (before trials began).	Season 1929-30.	Season 1930-31.	Season 1927-28 (before trials began).	Season 1929-30.	Season 1930-31.
All plots of low fertility.	0.52	13.44	8.72	1.04	14.00	10.28
	2.08	18.40	12.64	4.08	15.60	8.04
	4.20	18.96	10.80	4.16	17.32	15.60
	4.32	17.60	8.40	5.32	16.72	12.88
Totals ...	11.12	68.40	40.56	14.60	63.64	46.80
Averages	2.78	17.10	10.14	3.65	15.91	11.70
Differences	—	14.32	7.36	—	12.26	8.05
All plots of moderate fertility.	4.72	17.40	8.64	5.84	16.72	13.84
	7.32	17.92	11.48	6.60	18.12	10.72
	7.64	17.00	12.84	6.72	18.52	10.44
	8.28	20.72	14.32	9.36	18.16	12.88
Totals ...	27.96	73.04	47.28	28.52	71.52	47.88
Averages	6.99	18.26	11.82	7.13	17.88	11.97
Differences	—	11.27	4.83	—	10.75	4.84

The returns for the first maize crop following the green manure and fertiliser treatment indicated that only when the fertility of the land had been reduced to a very low level was the practice of fertilising the green manure crop likely to prove economical. The average of two seasons' results still support this conclusion, although on the low fertility plots the yield this season was somewhat heavier from the plots on which the fertiliser was applied direct to the maize, due apparently to the larger amount of residual fertiliser which was available for this season's crop. No evidence in favour of fertilising the green manure crop on moderately fertile land is yet furnished by these results.

The Relative Effect of Raw Phosphate Rock and Bone and Superphosphate.—In the season 1928-29 when the fertiliser was applied to the green manure crop, four plots were dressed with raw rock phosphate and another four with a mixture of one-third bone meal and two-thirds superphosphate, while a further eight plots were reserved for similar treatment the following season. In view of the different treatments given in previous years and the resulting performances of these plots, however, it was found impossible to divide them equally between the two kinds of fertiliser without giving a bias in favour of one or the other, and it was decided to apply each kind of fertiliser on separate halves of all the plots. In this way each of the fertilisers was applied direct to the maize on eight one-sixteenth-acre plots instead of to four one-eighth-acre plots, as was the case when the fertiliser was applied to the green manure crop in the previous season. The returns from the two fertilisers are tabulated below. To facilitate comparison of their relative effect, the plot yields for the season preceding the commencement of these trials are included.

Yields of Maize in Bags per Acre.

FERTILISERS APPLIED TO GREEN MANURE CROP.

	Yield before trials began, 1927-28.	Raw phos. rock, 1929-30.	Raw phos. rock, 1930-31.	Yield before trials began, 1927-28.	Bone and supers., 1929-30.	Bone and supers., 1930-31.
	0.52	13.44	8.72	4.72	17.40	8.64
	2.08	18.40	12.64	4.32	17.60	8.40
	4.20	18.96	10.80	7.32	17.92	11.48
	8.28	20.72	14.32	7.64	17.00	12.84
Totals ...	15.08	71.52	46.48	24.00	69.92	41.36
Averages	3.77	17.88	11.62	6.00	17.48	10.34

FERTILISER APPLIED TO MAIZE.

	Yield before trials began, 1927-28.	Raw phos. rock, 1929-30.	Raw phos. rock, 1930-31.	Bone and supers., 1929-30.	Bone and supers., 1930-31.
	4.08	17.20	8.56	14.00	7.52
	4.16	17.84	9.44	16.80	12.00
	5.04	13.44	10.08	14.56	10.48
	5.32	16.88	10.48	16.56	10.40
	5.84	16.64	14.08	16.80	13.60
	6.60	16.88	15.28	19.36	15.92
	6.72	19.04	12.96	18.00	12.80
	9.36	18.08	11.92	18.24	13.84
Totals ...	47.12	136.00	92.80	134.32	96.56
Averages	5.89	17.00	11.60	16.79	12.07

Where the fertiliser was applied to the green manure crops, the returns slightly favour the raw rock phosphate, but those for the plots on which the fertiliser was applied direct to the maize indicate equally beneficial effects from both kinds of fertiliser in both the first and second seasons.

In laboratory tests and under certain soil conditions, the phosphorus in raw rock phosphate has been proved to be less readily available for the use of plants than that contained in superphosphate, and this has been reflected in lower yields during the first season after application. In the present experiment, however, the raw rock phosphate has proved as efficacious as the bone and superphosphate in the first season. The results indicate that in this Colony on soils which are acid in nature and well supplied with vegetable matter, dressings of raw rock phosphate may normally be expected to increase the maize yield during the first season just as greatly as similar dressings of bone and superphosphate, and further, that owing to its lower cost the rock phosphate may well prove the more economical fertiliser.

Method of Application of Fertiliser Trials.—These investigations were undertaken at the request of the Maize Association with the object of ascertaining whether the manner in which fertiliser is applied to the land is likely to affect the yield of the maize crop. Fertilisers were applied in four different ways, namely:—

1. Broadcast during winter and ploughed in.
2. Broadcast shortly before planting time and harrowed in.
3. In drills at the time of sowing the seed.
4. In holes by hand with the seed at the time of planting in check rows.

Fertiliser was applied at the rate of 200 lbs. per acre. In the season 1928-29 a mixture composed of one-third bone and two-thirds superphosphate was used, but in 1929-30 and during the season under review Rodia Double Complete Fertiliser was given instead. A new site was also chosen for these experiments and the plots were arranged in the form of two Latin squares. Each method of applying the fertiliser was replicated eight times.

The following table records the yields of maize in lbs. per one-twentieth acre plot:—

Method of Applying Fertiliser.

Lbs. per plot of one-twenty-fourth acre.

	Ploughed in.	Harrowed in.	Drills.	Holes.	
Experiment No. 1—	37	56	64	60	
	48	41	47	73	
	75	47	62	84	
	97	52	88	66	
Totals of 4 plots	239	196	261	283	S.E. = 9.0
Bags per acre ...	7.17	5.88	7.83	8.49	S.E. = 0.27
Experiment No. 2—	74	40	64	63	
	67	67	73	65	
	68	67	65	69	
	63	43	75	79	
Totals of 4 plots	272	217	277	276	S.E. = 14.2
Bags per acre ...	8.16	6.61	8.31	8.28	S.E. = 0.426

S.E. = Standard error.

In the first experiment, owing apparently to localised soil infertility, one plot on which the fertiliser was ploughed under gave a very low yield, and, owing to this, the yield from the plots fertilised in that manner that year appear lower than they otherwise would. That this result should be taken with reserve is shown by the second experiment, in which three out of the four methods of applying the fertiliser have proved equally efficacious. But where the fertiliser was broadcasted on the surface and harrowed in, the response to the treatment was definitely less in both experiments. This season's results therefore corroborate those previously reported.

On the plots on which the fertiliser was concentrated near the maize plants, the acceleration of the vegetative growth during the first two months was very marked. There are differences of opinion as to whether forcing the growth in this way is advantageous or otherwise. Some favour it, because the plants are assisted in their competition against weeds and earlier use of inter-row cultivators is made possible. Other farmers, who use drag harrows for the preliminary weedings, prefer the comparatively wiry early growth which results when the fertiliser is broadcasted, because it permits the harrows to be used two or three times before the plants become too large to be further cultivated by such means. It may be observed also

that large plants which are deep green in colour are more attractive to stalk-borer moths than less luxuriant plants.

That the harrowing-in of fertiliser should prove less effective than the other methods is unfortunate, because under general conditions this is the least expensive and most convenient method of application. The question arises as to whether the proportion of the fertiliser constituents not used by the crop the first year may not be utilised in the following year, in which case, when regular application of fertiliser is practised, the temporary loss of a small proportion may not prove serious.

To investigate this aspect of the problem, it is proposed to re-arrange the plan and in future to practise each method of applying fertiliser on its own particular group of plots over a period of years, when, if after the first year or two the yields of the "harrowed-in" plots equal those of the other methods, that method of applying the fertiliser will have been shown to be the most economical, in spite of the temporary loss of a bag or two of maize the first season.

Cultivation Trials.—The *raison d'etre* for these investigations was the announcement by certain investigators that the maintenance of a soil mulch as a result of cultivation had no beneficial influence on crop yields, apart from that conferred by the destruction of weeds. The experiments were laid down in 1928-29 to investigate the truth of this theory under local conditions, and the methods of treatment were as follows:—

(a) Weeds allowed to grow unchecked.

(b) Weeds removed without disturbing the surface of the soil.

(c) Weeds destroyed and soil mulch formed by the usual methods of machine and hand cultivation.

In the first season weed infestation was light, the rainfall was ample and evenly distributed and there was little difference in the yield of the plots under the different treatments. In the following season the land was considerably more weedy and the weeds were allowed to seed, with the result that in 1930-31 there was a heavy infestation of weeds over all the plots.

During the seasons 1929-30 and 1930-31 the rainfall was less than normal towards the end of the season and the presence of weeds had a decidedly harmful effect. In the table given below the mean yield of each series of replicated plots is expressed as a percentage of the mean of all the plots in the series.

Season.	Rainfall during the month of March.	Weeds unchecked.	Weeds removed.	Usual cultivation.
1928-29	6.30 ins.	97.1%	102.5%	101.4%
1929-30	3.75 ins.	85.7%	101.5%	112.9%
1930-31	1.11 ins.	...	...	...
Series No. 1 ...	...	48.7%	99.7%	151.3%
Series No. 2 ...	...	63.7%	110.8%	122.2%

Yields of Maize in Bags per Acre.

Season.	Rainfall during the month of March.	Weeds unchecked. Per cent.	Weeds removed. Per cent.	Usual cultivation. Per cent.
1928-29	6.30 ins.	24.64	26.03	25.85
1929-30	3.75 ins.	14.59	17.27	19.21
1930-31	1.11 ins.	...	...	...
Series No. 1 ...	..	4.56	9.33	14.16
Series No. 2 ...	..	12.71	22.79	24.41

It is considered that these returns conclusively indicate that in Southern Rhodesia at least, weed suppression is not the only factor responsible for the beneficial results which follow thorough cultivation, but that the maintenance of a loose surface mulch is also materially helpful, either because it checks evaporation or because it facilitates the penetration of rains into the soil, or by a combination of both these effects.

One Ploughing versus *Two Ploughings for Maize Production.*—In some countries it is the usual practice to cross-plough land before seeding, in addition to the preliminary autumn or winter ploughing, and the object of this experiment was to investigate the question of whether the yield of maize would be increased by ploughing the land a second time in addition to the usual winter ploughing.

With these plots all the land was ploughed, rolled and harrowed during the winter months. After soaking rains had fallen the area was divided into four blocks, each of which was sub-divided into two, one of each pair being further dug

over by hand, while on the other this process was omitted. The second working being by hand, the work was probably performed a good deal more thoroughly than it would have been by the plough and better results might therefore be expected.

In order that the influence of the differences in inherent fertility of the plots might be overcome as far as is possible, the plots which were once ploughed last season were twice ploughed this season and *vice versa.*

The following table shows the yields over two seasons:—

Yields of Maize in Bags per Acre.

Season.	Block 1. Ploughed: once.	twice.	Block 2. Ploughed: once.	twice.	Block 3. Ploughed: once.	twice.	Block 4. Ploughed: once.	twice.	Mean yields of 4 blocks. Ploughed: once.	twice.
1929-30 ...	21.48	22.24	20.76	22.52	21.72	20.84	19.76	22.36	20.93	21.99
1930-31 ...	13.20	13.68	16.70	15.50	13.68	12.80	13.44	15.12	14.26	14.28
Average for 2 seasons	17.34	17.96	18.73	19.01	17.70	16.82	16.60	18.74	17.60	18.13

These returns show an average annual increase of half a bag per acre in favour of the plots which were twice ploughed, but it is doubtful whether this was due as much to the second ploughing as to the higher natural fertility of the plots which were twice ploughed in the first season. It will be noticed that the second season's yields favour twice ploughing by only .02 bag per acre, and it is thought therefore that the indicated increase of one bag per acre in the first season may have been largely due to other circumstances than the additional "ploughing."

These trials seem to confirm the general opinion that one thorough ploughing followed by adequate surface working is sufficient, and that a second ploughing is not likely to prove economical unless it is done for specific reasons, such, for example, as to destroy weeds, or turn in fertiliser or manure.

The Effect of Cultivating Young Maize with Spike-toothed Harrows.—There exists considerable diversity of opinion amongst farmers as to whether the cross-harrowing of young maize crops is advisable or otherwise. These experiments were devised for the purpose of obtaining information

which would be helpful to farmers in deciding whether harrowing may safely be practised, or whether it is more expedient to employ less drastic means of ridding the land of weeds.

The trials were conducted over a period of two seasons. The maize was sown in rows 40 inches apart and the plants were spaced at four different distances in the rows, namely, 8 inches, 12 inches, 15 inches and 15 inches with two grains per hill, to allow of subsequent thinning to one plant per hill. Each season the seed bed has been well prepared and a set of harrows of medium weight, drawn by six oxen, have been used. The absence of trash and clods probably made conditions somewhat more favourable than would pertain on the average farm. Each season the crop has been twice harrowed transversely to the direction of the rows, the first harrowing being given about fifteen days after sowing the seed, and the second ten days later. The plots were replicated five times in 1929-30 and six times during the season under review.

The following table indicates the percentage of plants which were destroyed by the harrows, and the yields, the figures given being the means of the replicated plots.

Yields of Maize in Bags per Acre.

Distance between plants in row	8 ins.			12 ins.			15 ins.			15 ins. (Two grains sown per hill.)		
No. of plants per acre ...	19,602			13,068			10,454			10,454		
Season.	Per cent. destroyed: 1st	2nd	Yield, bags p.a.	Per cent. destroyed: 1st	2nd	Yield, bags p.a.	Per cent. destroyed: 1st	2nd	Yield, bags p.a.	Per cent. destroyed: 1st	2nd	Yield, bags p.a.
1929-30	1.7	7.4	13.93	3.3	18.0	14.96	4.2	19.0	14.63	2.2	11.2	13.44
1930-31	0.6	3.5	12.29	0.9	4.4	13.86	1.5	6.8	11.93	1.2	2.9	10.98
Totals	2.3	10.9	26.22	4.2	22.4	28.82	5.7	25.8	26.56	3.4	14.1	24.42
Averages ...	1.2	5.5	13.11	2.1	11.2	14.41	2.9	12.9	13.28	1.7	7.1	12.21
Ratio of destruction of 1st harrowing to 2nd harrowing ...	1:4.6			1:5.3			1:4.4			1:4.2		

These returns indicate that the number of plants destroyed by the second harrowing was more than four times as great as those destroyed by the first harrowing, which caused an average loss of only 2 per cent. Of the 44 plots in these experiments, only one sustained a loss as high as 6 per cent. as a result of the first harrowing. It will be seen therefore that usually this means of cultivation may be safely employed when the maize plants are between one and two weeks old, if precautions are taken to prevent the harrows from becoming clogged with maize and weed trash, clods, etc. After the plants have reached the height of one foot there is more risk of destroying them, and during the early hours of the day and on dull days, at which times the stems are turgid, harrowing should not be practised.

In both seasons heavier yields were obtained where the plants were spaced at 12 inches apart in the rows. It is thought that this was largely due to chance, but it may be noted that in 1929-30, when the stand was reduced by 21.3 per cent., nearly 3,000 plants per acre were destroyed, making the average distance between the remaining plants 15.2 inches, and for the same reason where the plants were first spaced at 15 inches apart, the average distance between plants in the final stand was increased to 19.5 inches. It was observable that at the second harrowing a much larger proportion of the plants was destroyed where the soil was very loose and friable, due apparently to the deeper penetration of the spikes causing the framework of the implement to flatten the plants so much that a number were broken off and others were covered with soil. This suggests that harrows with long spikes may be found preferable for use on open and sandy soils. The returns further indicate that where the plants were more widely spaced in the rows, a larger proportion were destroyed by the harrows. This is contrary to expectation and no explanation for it can be given.

Owing to the limited area available for these trials, and the necessity for the replication and randomisation of experiment plots, it was not possible to include areas on which harrowing was not practised.

Although somewhat incomplete, these trials have served a useful purpose in demonstrating that when this method of cultivation is employed, the stand will not be seriously reduced if reasonable precautions are taken. They also indicate that on weed infested land where the harrows may need to be used two or three times, it may be advisable to allow for a 15 to 25 per cent. reduction of the stand by sowing the maize somewhat closer in the rows.

THE CONTROL OF WITCH WEED

BY TRAP-CROPPING WITH SUDAN GRASS.

By the Division of Plant Industry.

The following interesting report has been forwarded to the Chief, Division of Plant Industry, by Mr. George Gray, of Brawlands Farm, Glendale, and should be read carefully by all maize growers who are so unfortunate as to have lands infected with witch weed:—

"In 1929-30 I had 30 acres of exceptionally good soil, which, however, was very badly infested with witch weed; so much so, indeed, that I only reaped just under two bags per acre.

"For the following year your Assistant Agriculturist, Mr. Timson, advised me to try Sudan grass as a trap crop, and this I did, using 25 lbs. of seed to the acre, broadcasted and harrowed in. The seed was sown on the 20th December, 1930, the land having been first ploughed. Eight weeks later I reaped a very fine crop of Sudan grass hay, which, in my opinion, is a very valuable cattle food.

"I then ploughed in 15 acres of the stubble without seeing any sign of witch weed. During the ploughing process Mr. Timson visited the farm and we both searched very

carefully, but could not find one single witch weed plant on this land. Mr. Timson, however, was of the opinion that the parasite had germinated, and this year's crop of maize certainly goes to prove that he was correct.

"On the other 15 acres I intended to keep the second growth for seed, but I happened to visit this part of the farm about ten days later and found that witch weed was in flower all over this area. I therefore decided to plough under at once the Sudan grass stubble and the witch weed showing amongst it. This season I planted maize on the whole of this 30 acres and expect to reap at least 14 bags to the acre, in spite of the fact that the ground was not fertilised. Witch weed has been present amongst the maize, but in such small quantities as to be easily controlled. It has been most prevalent on the 15 acres where the Sudan grass was allowed to make a certain amount of second growth, and where the witch weed was thus given an opportunity to flower and apparently to seed.

"Sudan grass as a green manure crop, in my opinion, is of even more value than Sunn hemp, since it has the advantage of being a host for witch weed. On the land which I had under Sunn hemp last season, I certainly have a really good crop of maize this year, but I have also easily ten times more witch weed."

In connection with the final observation in Mr. Gray's report, it appears usual for the infestation of witch weed (if it occurs in a field) to show an increase following a green manuring. The reasons probably are (1) that little or no seed of the parasite germinated under the Sunn hemp crop and there was thus all the more lying dormant in the land to germinate the following season, (2) the increased root development of the maize due to the increased fertility of the soil brought the roots into contact with and germinated a larger number of witch weed seeds than would the smaller root system of a less vigorous maize crop.

TOMATO GROWING AT CERES, SHAMVA.

[*The following notes on tomato growing have been supplied by Mr. A. R. Morkel, of Ceres, Shamva. This farm is probably well known to many of our readers; it is situated a few miles south of Shamva at an altitude of approximately 3,600 feet. The soil is a deep rich loam, varying from red to chocolate in colour to almost black. It is fortunate in the possession of an irrigation system with sufficient water to irrigate 800 acres of land. The orchards, wheat lands and vegetable gardens are all under the irrigation furrow.*

The climate is almost tropical, and the farm is sufficiently sheltered to be protected from frosts.

As might be expected, tropical fruits do well, but all attempts to grow deciduous fruit trees have been a failure.—Ed.]

Soil Preparation.—Tomatoes are grown on the best available patches of soil. Black and red soils are both good, but there should be plenty of humus. Green crops—Sunn hemp preferably, but velvet beans and cow peas are both useful—are the rule when there is no kraal manure. The latter at the rate of ten to fifteen tons per acre is the best provision of humus. A liberal supply of phosphates is given to the tomato crop in addition to the kraal manure, dressings being from three hundred to four hundred lbs. per acre. The ploughing under of a thick Sunn hemp crop (sowings being thirty to forty lbs. Sunn hemp seed to the acre) is one of the best means of getting humus and obtaining a good friable soil such as the tomato loves. A top dressing of sulphate of ammonia given to the transplants after they are set out for a week or two gives them a very noticeable push, which helps the plants to go ahead without any setbacks.

Seeding.—The seed-beds are established in a nice, warm corner close to irrigation and well away from low-lying wet lands. Enough seed is sown every Monday from the end of January until the beginning of August to enable ten boys to be busy once a week transplanting when the plants are two to four inches high. Liberal dressings of kraal manure (in this case sheep manure), phosphates and sulphate of ammonia are given to the seed-beds. This gives vigorous transplants—a necessity if a good crop is required.

Transplanting.—Care in the usual way must be exercised in digging up the young plants. The transplants should be removed gently, disturbing the soil surrounding the roots as little as possible. The plantlets are placed in boxes covered with a sack and taken to the field, where the land has already been prepared in the following manner. It is first ploughed, harrowed and then ploughed and harrowed again until in good tilth and there are no clods visible. Between the first ploughing and harrowing and the last one the kraal manure is scattered. The second ploughing buries this properly. When the soil is in a satisfactory condition, boys make furrows four feet apart and about twenty to thirty yards long. Too long a furrow causes erosion at the upper ends, and a furrow at a grade which causes the water to dam up is not good for tomatoes. Into these furrows water is now led until they are thoroughly damp. The phosphates are then evenly distributed and the trench filled ready for planting. The plants are set out from three to four feet—preferably four feet—apart in the rows. Immediately after irrigating the soil is hoed up around the plants, thus making practically a new channel for the water to flow down. This will in the end bring the rows of tomatoes in the middle of the hoed-up row. This is done to prevent the soil being washed away from the roots of the plants and to obviate all caking and hardening of the soil near the roots.

The success of tomato-growing is dependent on proper treatment of the soil, due regard to weather conditions, patient, frequent and careful cultivation, spraying with the necessary fungicides, careful picking and packing, and perhaps above all—orderly marketing.

Staking, etc.—When the plants are from a foot to eighteen inches high they are pruned. Pruning consists of pinching off all stems but two—or at the most three—for a distance of at least six inches from the ground. It will be noticed that immediately after the pruning the growth improves remarkably. The pruning finished, each four plants are tied to stakes, and these stakes in turn are tied together. When a crop is growing well it may also be necessary to tie the branches to the stakes as the plant reaches a higher level.

Varieties.—"Perfection" has been grown for many years on this farm. It grows well, keeps well, packs well and sells well. "Ponderosa" is a new variety here, but it promises to do extremely well. If the fruit is as good as it is claimed to be, then this variety will give great satisfaction. There are already clusters of fruit and abundance of clusters. The growth of the plants has been more vigorous than any other varieties grown here hitherto. "Sunrise": This is a variety of a pleasing colour and beautiful shape, and promises to be a good second to "Ponderosa" in its attractiveness, and like the latter it is later than "Perfection" and can therefore be marketed at a time when winter-grown tomatoes should be in good demand.

Diseases and Pests.—The only diseases that have been a source of trouble are mosaic and wilt. Care is taken to pull up and immediately destroy all plants in which the mosaic makes its appearance. Sometimes about five per cent. of the plants are affected by mosaic, but generally it is much less.

Wilt is something I have still to study. Very little information is as yet available with regard to the cause of wilt. It has been noticed here that this disease attacks old and young plants, vigorous plants just commencing to fruit and old plants that have been bearing for a couple of months all at the same time. It has also been remarked that a few crops well away from the main crop do not become affected. It is hoped that an experiment this year with a plot under irrigation, but at least half a mile away from the land under the main crop, will give results by which we will know if it is the proximity to the main crop which causes the younger plants to become infected with wilt. Perhaps after having

grown tomatoes in a frostless region throughout the winter it is too much to expect them to grow during the summer and rainy season as well.

I make my own Bordeaux mixture, using 6 lbs. copper sulphate and 4 lbs. quick lime to 50 gallons of water. The copper sulphate I buy from the Postal Department at 4d. per lb. The mixture requires careful straining through a fine mesh before use to get rid of the small particles of lime which are liable to choke the spray. A spray of tobacco juice is also beneficial to get rid of beetles that destroy the flowers occasionally. This latter pest is, however, not serious.

Several piccanins have to watch that birds do not eat the fruit, and in spite of this labour quite an appreciable amount of fruit is thus destroyed. All marked and damaged fruit is picked every day and given to the pigs, which thrive on it.

In sorting, a large number of over-ripe fruit always comes to the grading table, and this also is sent to the pigs.

Packing.—This is done for most dealers in boxes containing from twenty to twenty-three lbs. nett weight of tomatoes. Banana leaves are placed at the bottom and top and between the two layers of fruit. It is advisable to pack the fruit fairly tightly without squeezing it. All fruit of one size is packed in each box, but not all of one degree of ripeness. This is done to allow the buyer a percentage of his purchase to ripen gradually, so that he has no waste on his hands through over-ripe fruit. I have known tomatoes from this farm, well packed, to be in a good state of preservation for eating nearly a month after they were picked.

Selling.—It is of great help to have an attractive label, so that it may be known as a well-packed fruit. Fruit of any kind, if it does not look tasty, will not sell well. Tomatoes from Ceres have a good name from Beira to Bulawayo, and even up to Northern Rhodesia.

Yields.—No very accurate records have been kept of yields hitherto. Tomatoes have been sold as follows from the acreages mentioned, but in addition a large quantity of each year's yields was given to the labourers and to the pigs, such fruit being over-ripe for selling purposes.

Year.	Acres.	Tomatoes sold.	Yield per acre.
1928	4	48,000 lbs.	12,000 lbs.
1929	4½	54,000 lbs.	12,000 lbs.
1930	8	126,020 lbs.	15,765 lbs.
1931	15	207,360 lbs.	13,824 lbs.

These figures are only approximate, but can be accepted as a guide to enable one to estimate what yields are to be expected from well-managed fields of tomatoes.

The crop is an expensive one to grow and the nett profit is not all that it might be, but there are few crops that are more interesting.

GWEBI PRODUCE PRICES.

Hull-less oats	40/- per bag of 150 lbs.
Large Black sunflower seed ...	14/- per bag of 100 lbs.
Dolichos beans	35/- per bag of 200 lbs.
Linseed	60/- per bag of 200 lbs.
Linseed (quantities under 100 lbs.)	4½d. per lb.
Sweet potato tubers (Calabash Leaf)	6/- per bag of 150 lbs.
Napier fodder roots	6/- per bag of 40 lbs.
Sweet potato cuttings (Calabash Leaf)	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.
Pumpkin seed	1/1 per lb.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

A LIST OF PLANT DISEASES OCCURRING IN SOUTHERN RHODESIA.

SUPPLEMENT 2.

(June, 1931, to May, 1932.)

Compiled by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.

This second supplement to the original list published in 1930 consists of newly recorded diseases for the year June, 1931, to May, 1932, and also includes several fungi collected prior to 1926 by Mr. F. Eyles and not included in his preliminary list (*Bull.* 602, *Dept. of Agric.*, Salisbury, 1926). The latter are indicated by the symbol (*F.E.*).

I am indebted to the Director and staff of the Imperial Mycological Institute and to Miss E. M. Wakefield for a number of determinations.

ALOE (*A. greatheadii* Schoenl.).
Rust. *Uromyces aloes* (Cke.) P. Magn.

ARAUCARIA (*A. braziliana* A. Rich.).
Die-back. *Botryodiplodia theobromæ* Pat.

ASTER (*Aster* sp.).
Leaf Blotch. *Alternaria* sp.

BAMBOO (*Bambusa* sp.).
Foot Rot. *Helminthosporium* near *sativum* Pammel, King and Bakke.

BARBERTON DAISY (*Gerbera jamesonii* Hook.).
Mildew *Oidium* sp. (? *Erysiphe cichoracearum* DC.).

BARLEY (*Hordeum* spp.).
Foot Rot. *Fusarium* sp.

BAUHINIA (*Bauhinia macrantha* Oliv.).
Leaf Blotch *Cercospora ? latimaculans* Wakef.

BEANS.
Broad Bean (*Vicia faba* Linn.).
Mosaic. Virus.

Soya Bean (*Glycine soja* Sieb. & Zucc.).
Leaf Spot *Bacterium glycineum* Coerper.
Mosaic. Virus.

Sword Bean (*Canavalia ensiformis* DC.).
Leaf Blotch *Alternaria brassicæ* (Berk.) Sacc. var *phaseoli* Brun. affin.

Berlinia globiflora Hutch. & Burtt Davy.
Mildew *Erysiphe* sp.

BLACK JACK (*Bidens pilosa* Linn.).
Smut *Entyloma bidentis* P. Henn.

Brachystegia randii Bak. f.
Anthracnose *Colletotrichum lindemuthianum* (Sacc. & Magn.) Br. & Cav. affin.

CARNATION (*Dianthus caryophyllus* Linn.).
Leaf and Stem Spot. *Phyllosticta dianthi* West.

CHRYSANTHEMUM (*Chrysanthemum* spp.).
Rust. *Puccinia chrysanthemi* Roze.

CITRUS.
Lemon.
Storage Rot *Penicillium italicum* Wehm.

COFFEE (*Coffea arabica* Linn.).
Brown Blight *Glomerella cingulata* (Stonem.) S. & v.S.
(=*Colletotrichum coffeanum* Noack.)

COLEUS (*Coleus* sp.).
Foot Rot *Pythium debaryanum* Hesse.

COTTON (*Gossypium* spp.).
Leaf Spot *Mycosphærella gossypina* (Cke.) Atk.
Seedling Blight *Rhizopus stolonifer* Ehrenb.
Sooty Mould *Fumago vagans* Pers.

COTYLEDON (*Cotyledon* sp.).
Purple Rot *Phytophthora parasitica* Dast. emend. Ashby and *Rhizoctonia* sp.

COWPEA (*Vigna catjang* Wolfs.).
Anthracnose *Colletotrichum lindemuthianum* (Sacc. & Magn.) Br. & Cav.

DAHLIA (*Dahlia* spp.).
Tuber Rot *Cephalothecium roseum* Ferraris.

DELPHINIUM (*Delphinium* sp.).
Foot Rot *Pythium debaryanum* Hesse.

Desmodium leiocarpum G. Don.
Leaf Spot *Colletotrichum* (*atramentarium* group).

Dolichos lupiniflorus N. E. Br.
Mildew *Erysiphe polygoni* DC.
Rust *Æcidium* sp. (*Uromyces appendiculatus* affin.)

Doryalis sp.
Leaf Spot *Coryneum doryalidis* van der Byl (*F.E.*)

EGG PLANT (*Solanum melongena* Linn. var. *esculentum* Nees.).
Mildew *Oidium* sp. (in glasshouse).
Rust *Æcidium habuguense* P. Henn.

EUCALYPTUS (*Eucalyptus rostrata* Schlecht.).
Root Rot *Fusarium* sp.

Euphorbia prostrata Ait.
Rust *Uromyces proëminens* (DC.) Lév.

GRAM (*Dolichos biflorus* Linn.).
Leaf Spot *Cercospora canescens* Ell. & Mart. affin.
Mildew *Oidium* sp. (? *Erysiphe polygoni* DC.).

GRAPE VINE (*Vitis vinifera* Linn.).
Shrivelled Fruit. Associated with *Aspergillus niger* v.Tieg.

GRASSES.
Acroceras macrum Stapf.
Leaf Spot *Phyllosticta* sp.

Andropogon gayanus Kunth.
Rust. *Puccinia versicolor* Diet. & Holw.

Andropogon shirensis Hochst.
Rust. *Puccinia erythrææënsis* Pazschke.

Brachiaria brizantha Stapf.
Leaf Spot *Phyllachora sanguinolenta* Theiss & Syd. var. *microspora* Doidge.

Dicanthium papillosum Stapf.
Smut *Ustilago ? dinteri* Syd.

Digitaria setivalva Stent.
Rust *Puccinia digitariæ* Pole Evans. affin.

Hyparrhenia filipendula Stapf.
Leaf Spot *Leptostroma* sp.

Panicum maximum Jacq.
Rust *Uromyces leptodermus* Syd.

Pennisetum ciliaris Link (= *P. cenchroides* Rich.).
Ear Mould *Cerebella cenchroidis* Subram. affin.

Pogonarthria squarrosa Pilg.
Rust *Puccinia* (? sp. nov.).

Rhynchelytrum roseum Stapf. (= *Tricholæna rosea* Nees.).
Leaf Spot *Phyllachora tricholænæ* P. Henn.

Sorghum sudanense Stapf.
Downy Mildew *Sclerospora graminicola* Schroet.

Themeda triandra Forsk.
Ear Mould *Cerebella andropogonis* Ces. affin.

Urochloa pullulans var. *mosambicensis* Stapf.
Ear Mould *Cerebella panici* Tracey & Earle affin.
Rust *Uromyces leptodermus* Syd.

GUAR (*Cyamopsis psoralioides* DC.).
Wilt *Fusarium* sp. near *vasinfectum* Atk.

HOLLYHOCK (*Althea rosæ* Cav.).
Foot Rot *Pythium* sp.
Leaf Spot *Ascochyta parasitica* Faut., associated with aphis.

HYDRANGEA (*Hydrangea* sp.).
Leaf Spot *Colletotrichum* sp.
Mildew *Oidium sp.*

KUDZU (*Pueraria thünbergiana* Benth.).
"Halo" Spot *Bacterium medicaginis* var. *phaseoticola* (Burk.) Link. & Hall. (= *B. puerariæ* Hedges).

LETTUCE (*Lactuca sativa* Linn.).
Damping-off *Pythium deburyanum* Hesse.
Leaf Spot *Septoria lactucæ* Pass.

Leucas martinicensis R. Br.
Rust *Puccinia leucadis* Syd.

MAIZE (*Zea mays* Linn.).
Seed Infection *Aspergillus niger* v.Tieg.

Nicandra physaloides Gærtn.
Leaf Spot *Alternaria* (*solani* group Mason.).
Mosaic. Virus.

OATS (*Avena sativa* Linn.).
Stem Rust *Puccinia graminis* Pers.

Pedilanthus tithymaloides Poit.
Mildew *Oidium* sp.

PETUNIA (*Petunia* spp.).
Mildew *Oidium* sp. (? *Erysiphe cichoracearum* DC.).
Mosaic. Virus.

PHLOX (*Phlox drummondii* Hook.).
Leaf Spot *Septoria drummondii* Ell. & Ev.

POTATO (*Solanum tuberosum* Linn.).
Black Dot *Colletotrichum atramentarium* (Berk. & Br.) Taubh.
Common Scab *Actinomyces scabies* (Thaxt.) Güssow.
Mildew *Oidium* sp. (? *Erysiphe cichoracearum* DC.) (in glasshouse).
Wilt *Verticillium* (cf. *albo-atrum* Reinke & Berty) and *Fusarium culmorum* (W.G.Sm.) Sacc.

Pterocarpus erinaceus Poir.
Leaf Spot *Catacaumi pterocarpi* Doidge. (*F.E.*)

QUINCE (*Cydonia vulgaris* Pers.).
Leaf Spot *Fabræa maculata* (Lév.) Atk. (*F.E.*)

RHUBARB (*Rheum rhaponticum* Linn.).
Crown Rot *Phytophthora parasitica* Dast. var. *rhei* Godfr.

ROSE (*Rosa* sp.).
Leaf Spot *Glœosporium* sp.

SAFFLOWER (*Carthamus tinctorius* Linn.).
Leaf Spot *Alternaria* (*solani* group Mason.).

SESBANIA (*Sesbania* sp.).
Rust *Uromyces argyrolobii* Doidge.

STRAMONIUM (*Datura stramonium* Linn.).
Damping-off *Rhizoctonia solani* Kühn.
Seed Infection *Alternaria* (*tenuis* group Mason.).

SUDAN GRASS (*Sorghum sudanense* Stapf.), see Grasses.

SUNFLOWER (*Helianthus annuus* Linn.).
Dodder *Cuscuta arvensis* Beyr.
Neck-crack. ? Drought effect (cf. Chrysanthemum neck-crack).

SUNN HEMP (*Crotalaria juncea* Linn.).
Leaf Spot *Mycosphærella pinodes* Berk. & Blox.

SWEET POTATO (*Ipomœa batatas* Poir).
Ring Rot *Rhizopus stolonifer* Ehrenb.

SWEET SULTAN (*Centaurea moschata* Linn.).
Mildew *Oidium* sp. (? *Erysiphe cichoracearum* DC.).

TOBACCO (*Nicotiana tabacum* Linn.).
Leaf Curl. Virus.

TOMATO (*Solanum lycopersicum* Linn.).
Fruit Spot *Colletotrichum phomoides* (Sacc.) Chester.
Fruit Sunscald. Physiological.

VIOLET (*Viola odorata* Linn.).
Leaf Spot. *Alternaria violæ* (Gall.) Dors.

ZINNIA (*Zinnia* sp.).
Leaf Spot *Alternaria macrospora* Zimmerm. affin.

FARMING CALENDAR.

June.

BEE-KEEPING.

At this season hives require to be painted; the woodwork, being exceedingly dry, is in good condition to receive it. Linseed oil (unboiled) is the best kind to mix with white lead, as it is more penetrating, acting as a better preservative than boiled oil. Bees will be able to take beneficial flights during warm days, so that dysentery need not be anticipated.

CITRUS FRUITS.

Cultivation of the grove is to be continued. Early ripening fruit must be harvested and marketed without delay. Mid-season varieties will be fit for packing early in the month. These should be shipped as early as possible, so as to extend the late variety export season as much as possible. Most late ripening varieties will require irrigating during the month.

A small amount of pruning should be done. If fumigation is to take place, remove the small branches that touch the ground, cut out all dead wood and water shoots.

CROPS.

Select seed from the very best of your own crops. It is always wise to keep more seed than you may need for planting. Do not shell and ride your maize to the railway unless it is fit for export or market. If in doubt regarding the moisture content of the maize, send a 2 lb. sample in an air-tight tin, such as a golden syrup tin, to the Agricultural Department and have it tested. Provide ample dunnage for your maize stacked at the railway or on the farm. Use maize cobs; husks are almost useless for this purpose. Sew your bags of maize according to the export regulations and stack them properly at the railway side, leaving plenty of room between the double rows. Select pumpkin and melon seed from the best specimens. Support your agricultural show and make it a success by preparing and entering as many exhibits as you can. No one is more to blame for a poor show than the farmers themselves. Make a list of the seed requirements for next season, and where purchases must be made, place the orders early.

In cleaning up the cotton fields care will have to be exercised in the supervision of the pickers. The cotton harvested at this period of the season generally comes from late bolls naturally matured and those prematurely opened by the cold weather and frost. The matured seed cotton should be kept entirely separate from the immature seed cotton. There will also be some dirty and stained cotton in this final picking. Arrangements for next season's seed requirements should receive consideration.

Veld fires must be anticipated, and if not already attended to, the mowing or burning of fire-guards, both boundary and internal, should be proceeded with.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. During the winter months

the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. During cold weather it is frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

Under the cool conditions which obtain from this time of the year onwards, cheese-making operations are usually most successful.

Care should always be exercised, however, in using evening's milk. If the milk is over-acid it should not be used, or a hard, dry cheese will result. Morning's milk plus a starter usually gives the best quality of cheese. The starter should have a clean sour taste and smell. In early winter, milk for cheese-making frequently contains a high percentage of fat, and in order to firm the curd properly in the whey it is usually necessary to raise the scalding temperature a few degrees.

At this period of the year winter feeding of dairy stock should commence in real earnest. The milking cows should now be in fairly good condition, and in order to maintain a full flow of milk throughout the cold, dry months of winter, it is essential that liberal feeding be practised. As far as possible an attempt should be made to imitate summer conditions by feeding an abundance of succulent and palatable food. Maize silage, sweet potatoes, pumpkins, etc., are very useful for this purpose, but these feeds should be supplemented by dry roughage of good quality, preferably a legume hay, and a liberal allowance of mixed concentrates.

For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

DECIDUOUS FRUITS.

General pruning may be done this month if the leaves have fallen. This should be confined, as far as possible, to the thinning out of diseased, weak, broken and dead shoots. Tall trees may be reduced in height, and old and unprofitable trees headed back to induce the growth of new fruiting wood. Trees that shed their leaves late may be pruned in July. The necessary preparations for planting trees should be completed during the month and planting commenced towards the end of the month. Cultivation should be continued.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during June.

Onions.—Suffer from thrip. The transplants may be dipped as far as the roots in tobacco wash or paraffin emulsion to keep down the pest.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

FLOWER GARDEN.

Annuals for early spring flowering should be sown, preferably in paraffin tins cut lengthwise, in a place sheltered from the wind. Perennials,

shrubs and ornamental tree seeds may also be sown. Fruit trees, shrubs and roses should be pruned and all dead wood removed. Sweet peas require constant attention.

VEGETABLE GARDEN.

All the available space in the garden should now be thoroughly trenched and manured, the soil being well worked and loosened. Vegetables planted out for winter crops should be well and continuously cultivated, which will help to bring them along quicker and with less watering. Late-bearing tomatoes should be sheltered from the cold winds by a grass shield. Beet, radish, carrot, parsnip, turnip, onion, leek, mustard, cress and tomatoes may be planted.

FORESTRY.

Care should be taken by further ploughing of land or burning of grass that all fireguards round plantations are in good order and effective. Thinnings where necessary may be continued, and fellings which are to be made are to be carried out. Cuttings may be taken and struck now of deciduous trees, such as the Carolina poplar. The pricking out of conifer seedlings into tins should be continued, and sowing of such seed for the coming planting season may be completed. A commencement may be made of preparation of land to be planted during the ensuing season, e.g., by stumping if necessary, and ploughing where practicable.

GENERAL.

Grazing is deteriorating, and the next few months may be a period of difficulty for the rancher. It is a mistake, frequently seen, for all the grazing nearest to the drinking places to be first consumed, so that later on the cattle, when least able to endure fatigue and when the grass is in any case most scanty and dry, have furthest to walk from the feeding ground to water. A little forethought can obviate this trouble. Live stock are usually in good condition at this time of year and able to travel longer distances to water than may be the case later on in the season. Fire guards to prevent grass fires should be looked to.

POULTRY.

The poultry keeper must be on the look-out for sudden cold snaps, for if some precautions are not taken, the production of eggs will drop.

This is one of the poultry keeper's busiest periods, but method, cleanliness and attention to details pay him well. Do not leave anything that you can spare the time to do yourself to natives. Watch carefully your breeding birds, and on the slightest sign of one going off, take him or her away; if left, you will have infertile eggs, weak germs, weak chicks difficult to rear, and later weak and unprofitable stock. See that the male bird has all the food he requires, and give him a meal by himself twice a week, also a small piece of raw meat three times a week. Those who are using incubators should watch the temperature of the room on cold nights, for variations in temperature result in delayed and poor hatches, and often deformed chicks.

STOCK.

Cattle.—Cows with autumn calves should be kept in the more sheltered paddocks. A watchful eye should be kept on all watering places in order to prevent their being fouled or stopped up. Where winter calves are required, the bulls should be kept out of the herd until the end of July at least, and, in the meantime, they should be well fed and cared for in order to fit them for their work. The three watchwords in the dairy herd should be feed, shelter and bedding from now onwards. Ensilage will now be found invaluable, as also will pumpkins, majordas or any other form of succulent food. Good hay should be used to rack up with at night, and the maize ration should be supplemented with ground nuts, ground nut cake or bean meal. Young calves are better in the pen on very cold morn-

ings until the sun has gained some power, when they may run on short, sweet veld for a few hours.

Sheep.—Continue to feed the ewes and lambs well. Older sheep should generally also be given some supplementary feed now. Sheep should not be allowed to get into low condition, especially in areas where parasite infection is to be feared.

TOBACCO.

The grading of tobacco should be proceeded with. Any bales stored on the farm should be turned occasionally, especially where more than one bale is placed on another. Arrangements for the grading of tobacco seed should be made for the coming season. Growers purchasing tobacco seed should place orders early with distributors of reliable seed.

VETERINARY.

Horse-sickness should be practically over now. Redwater and gall-sickness occur all the year round, but the worst time is the summer, when ticks are prevalent. Blue tongue should be very little in evidence now. Inoculation can be carried out now. Scab is a poverty winter disease.

WEATHER.

Casual rains may occur, but except on the eastern frontier, none is to be reckoned upon, nor can it be regarded as seasonable or desirable. Frosts generally occur on a few nights during the month of June, and precautions must therefore be taken. This month and the next are the coldest of the year, and when the cold is accompanied by dull weather or "Scotch mist," known locally as "guti," it is apt to have a severe effect on live stock, especially if grazing should at the same time be scarce and water supplies far to travel to.

July.

BEE-KEEPING.

The warmer bees are kept during this month so much the stronger will they come out in the spring. Provide a thickness of 3 inches of cloth coverings over the frames, and where quilts are, on examination, found to be damp, replace them with dry ones. This is a favourable season to carry out repairs to hives. All section and shallow frame combs must be carefully stored away from ants and mice, as these will be wanted for the excellent honey to be stored in them next October, collected from the bush bloom.

CITRUS FRUITS.

The harvesting of mid-season oranges should be completed early in the month; late varieties should be fit to export by the middle of the month. The dead wood should be broken and cut out of all harvested trees; this will minimise mechanical injury occurring with next season's fruit. Trees that are to be fumigated should have the lower lateral branches that touch the soil removed. Trim the trees until all foliage is just clear of the ground. The irrigation of late varieties must be continued and the cultivators kept going. Mark all trees when in fruit if the quality is bad; these may be cut back in August for top working to a good quality fruit. The soil of the early and mid-season varieties may be allowed to become fairly dry, for irrigation of the harvested trees may start an out-of-season growth which will enable pests to flourish and increase for the main spring blossoming flush.

CROPS.

Support agricultural shows, and add to your list of exhibits. Advertise your goods through the shows. Interested people will see them. If you require to make purchases of seed for next season, judge by the exhibits on the show what grower can best supply your needs, and place your orders accordingly. Attend the shows and go there to learn all you can about your business, not merely to have a good time. Seed maize previously selected in the field should be butted and tipped and hand shelled. Keep the butt and tip grain for check-row planting by hand. Do not over-irrigate winter crops, and do not irrigate when the wind is from the south, as this often means frost at this time of year. Troublesome weeds, such as darnel grass or drabok, may be removed from cereal crops by hand. Ploughing should be pressed on with, and maize stalks and roots of maize and other trash from the crop should be collected and burned very thoroughly. A land littered with unburnt and unrotted stalks and roots cannot be brought to a suitable tilth for planting and subsequent cultivation. Silage and sweet potatoes and other succulent feeds will have come into general use now, the potatoes being lifted from the land as required. The application of phosphatic fertilisers which are to be ploughed or harrowed in can be begun. Take the opportunity, during this and the next month or two, of inspecting all boundary and paddock fencing and gates, and effect repairs where required. Give a coat of paint to implements, wagons and carts. This protects the woodwork from rotting and the iron from rust.

DAIRYING.

This is one of the coldest months of the year, and milk production as a rule is low. Those cows which are being milked should receive a full winter ration of succulents (ensilage, pumpkins or majordas), hay and concentrates. Milking cows should either be under shelter at night or kraals should be sheltered against cold winds. The old adage, "Shelter is as good as a meal," should be remembered throughout the winter months.

No difficulty should be experienced in producing first-grade cream at this time. In cold, windy weather due precautions should be taken to ensure that the milk when separated is not below 90 degrees.

Most cheese-makers cease their cheese-making operations at the end of the month, as the milk generally not only is scarce, but begins to be deficient in butter fat. Cheese in the store-room should be carefully watched, as cheese mite is likely to appear on old mature cheese. In order to prevent the undue drying out of the cheese, the floor of the cheese room should be sprayed with water from a watering can.

Butter-making is sometimes difficult because of the low temperature of the cream. The temperature should be raised by immersing the can in warm (not hot) water until churning temperature is attained.

DECIDUOUS FRUITS.

Pruning must be continued, and if possible completed this month. The planting of all varieties is best if done now. Add a liberal amount of water at planting time, then cultivate the basins. Sufficient moisture will be thus retained to keep the newly planted trees going until tney start active growth. Repeat waterings when necessary. If trees arrive from the nurseryman in a dry and withered condition, immerse them in water for twelve or more hours until they regain turgidity; then plant. Running water is best. Keep cultivators going. It will be advisable to irrigate all trees towards the end of the month.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during July. Young louse-infested cabbage should be sprayed regularly with a forceful stream of water to dislodge the insects;

or if this fails, spray with tobacco extract and soap. The Bagrada bug is difficult to control. Strong tobacco wash and soap, resin wash or an oil spray may be effective, especially against the younger stages. Daily hand picking is useful. Keep plants growing vigorously.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

Maize Beetle.—Infested lands to be thoroughly ploughed throughout the winter.

FLOWER GARDEN.

Seeds of most annuals, perennials, shrubs and ornamental trees may be sown. The pruning of roses should be attended to early. Dahlias and other summer-flowering bulbs should be taken up, divided and replanted. Sweet peas require attention and staking.

VEGETABLE GARDEN.

Sow turnips, peas, cabbage, beet, carrots, parsnips, radishes, lettuce and spinach.

FORESTRY.

Care should be taken to protect all plantations from fire by hoeing or ploughing belts round them and burning any grass likely to be dangerous. Cuttings of various deciduous trees may be taken and struck in nurseries. Continue pricking out conifers into tins or beds. In preparation for early planting in case the season is favourable, limited sowings of tree seeds may be carried out. If labour is available, preparation of land for planting to be taken in hand.

GENERAL.

Veld fires must be watched for and arrangements made to combat them. The loss that may result and the penalties under the Herbage Preservation Ordinance are to be borne in mind. Fire guards should this month be burnt round all grazing which it is desired to preserve for use later on.

POULTRY.

With the cold weather that we generally have in July, the birds should have extra food, i.e., barley or maize, if the supply of eggs is to be continued. A mixture of stewed linseed and bran should be given to the birds, warm, the last thing before they go to roost. This gives them a little extra food during the long and cold hours of the night at this time of the year and maintains the body heat. A certain amount of shelter is also necessary to protect them from the cold winds. Grass wind breaks about 3 feet high on the windward side of the run are sufficient. Remember that no chickens should be hatched after August; those hatched later take much longer to develop than those hatched before August, and they are usually stunted, weakly and unprofitable. Each month the young stock should be gone through and graded; anything that does not promise to be good should be got rid of. As the hatching season draws to a close, the breeding stock, if not carefully watched and treated, will become run down, and infertile eggs and weak chicks will be the result. Watch the breeding stock carefully and handle them occasionally; if they feel thin and light or the flesh is not hard but flabby, give extra food and more scratching exercise. The male especially should be well looked after and given a meal on three or four days of each week by himself; in addition, he should have some raw meat as often as possible. Good hatching and strong, healthy chicks are wanted right up to the end.

Turkeys should now be in full lay. Never disturb the hens when they are sitting. They are very sensitive and nervous, and unless left mainly to themselves, are apt to desert the eggs or break them. It is recommended

that turkey chicks be reared by hand; the hens are poor mothers, they are clumsy, drag their chicks all over the place, and do not feed them as well as an ordinary hen does. The main thing is to keep the young turkeys warm, give them plenty of fresh air, thick separated milk and chopped onions or onion tops.

STOCK.

Cattle.—The bulls may again be put into the herd at the end of the month. Watch for any unthrifty cattle and get them into the home paddock and feed them before they become really poor. The value of a good provision for winter feed will be apparent now. Except under purely ranching conditions winter feeding should be general. Where areas have been properly reserved for winter grazing these should be in use now. The treatment of the dairy herd should be continued on the same lines as in June.

Sheep.—Vleis should now be fairly dry and may be utilised. There is, however, always the danger of internal parasites, and, where feed or grazing can be provided elsewhere, it is better to avoid vleis.

VETERINARY.

Horse-sickness and blue tongue should now have disappeared. Redwater and gallsickness occur all the year round, but the worst time is during the summer, when ticks are prevalent. Sheep may be inoculated against blue tongue now. Scab in sheep will probably be in evidence this month.

WEATHER.

Though rains have fallen during every month of the year in Rhodesia, none is looked for or desired this month. Most stations record an average of .01 to .3 inch over a number of years. Severe cold is likely to occur at this time of year, the lowest temperatures occurring an hour or two before sunrise. Frosts may be looked for, especially on calm clear nights. Cold windy days and damp "guti" weather tell severely on cattle, if shelter and food are not provided.

SOUTHERN RHODESIA VETERINARY REPORT.

March, 1932.

AFRICAN COAST FEVER.

MELSETTER DISTRICT.

Springvale.—Most of the cattle on Springvale were slaughtered, and the remainder will be destroyed in April.

Roede Farm.—The disease was diagnosed on this farm; mortality, two. The appearance of coast fever on this farm

confirms the fact that the oxen which passed through en route to Melsetter from the infected farm Tilbury in May last year were infected at the time. The cattle on Orange Grove are also involved, as they dip with the Roede cattle on Orange Grove annexe.

Melsetter Commonage.—A case occurred on the commonage which is also due to infection from Tilbury oxen.

Constantia and Clifton.—Three cases occurred on these farms, and as the cattle dip with those on the farms Corner, Dunblane, Rocklands, Westfield and Jamieson, a considerable area and number of cattle are involved.

FOOT AND MOUTH DISEASE.

Gwelo Veterinary District.

Infection has spread to several more camps in the Central Estates, Chilimanzi district. The disease is clearing up in the Charter, Selukwe and Belingwe districts.

Bulawayo Veterinary District.

Belingwe District.—The cattle at High Peak were inoculated. Infection was found to exist south of the inoculated area on Belingwe Reserve, and is being dealt with.

Bubi District.—The Battlefields Block and Ntabazinduna Reserve are now clean, and the Shangani Ranch is clearing up.

Victoria Veterinary District.

No further outbreaks. The disease is clearing up in all areas, and the whole of the Chibi district is now clean.

Salisbury Veterinary District.

The last infected centre, Chiweshe Reserve, has been declared clean.

HORSE-SICKNESS.

Nineteen cases reported from the Bulawayo veterinary district and five from Gwelo.

TRYPANOSOMIASIS.

Cases reported from two farms on the eastern border, Melsetter district, and on one farm in the Gatooma area.

MYIASIS (SCREW WORM IN CATTLE).

This is very prevalent in some districts, and especially so in foot and mouth disease infected herds.

BLUE TONGUE.

Heavy losses have been reported amongst sheep in the Melsetter district in spite of inoculation.

SNOTZIEKTE.

Two cases reported on the Central Estates, Chilimanzi district.

ANAPLASMOSIS AND PIROPLASMOSIS.

Both redwater and gall-sickness have been more in evidence this season, due to relaxation of dipping owing to the existence of foot and mouth disease and restricted movements.

IMPORTATIONS.

From the Union of South Africa: Cows and calves, 4; bulls, 17; heifers, 25; horses, 8; sheep, 1,609; goats, 90; pigs, 57.

EXPORTATIONS.

Nil.

CORRECTION—FOOT AND MOUTH DISEASE.

In the report for December, 1931, it was stated that some infection still existed on Sections 1, 4, 6 and 9 of Liebig's. This was incorrect. There was no infection on Sections 1 and 6 of Liebig's, but on Sections 1 and 6 of the Cattle Inspector's area in the Tuli section of the Gwanda district.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA WEATHER BUREAU.

APRIL, 1932.

Pressure.—The barometric pressure was generally slightly below normal, except at Bulawayo.

The semi-permanent anticyclone was established at the beginning of the month and maintained its position, being reinforced on the 7th by a high which appeared on the south coast; it was broken up on the 19th by a low on the south coast, but reappeared on the 22nd and remained until the 25th. A weak high appeared on the 27th. On the 29th a high appeared on the south coast and moved in a northerly direction.

Small lows passed along the south coast in the early part of the month, but were too weak to affect local conditions. On the 18th a low appeared on the south coast, and on the 19th and 20th was off the south-east coast and very deep. A second low appeared on the south-west Cape on the 24th, and was off the south coast on the 25th.

Temperatures.—The maximum temperatures were generally low and the minimum temperatures high, leaving the mean temperature about normal.

Rain.—Showers were recorded every day during the month. Light isolated showers occurred from the 1st to the 14th; on the 15th and 16th showers were numerous in the north and west, and continued in the north on the 17th. Isolated showers fell on the 18th and 20th. Scattered showers fell on the 21st, becoming numerous from the 22nd to the 25th and fairly general on the 26th. Light showers continued to fall up to the end of the month.

Seasonal Rainfall.—The rainfall for the month of April was approximately 1.8 inches, making the seasonal total 28.9 inches, or 1.5 inches above normal. These figures are approximate, as a number of returns are still outstanding.

APRIL, 1932.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen ° F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet).
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal.	No. of Days.	
Bulawayo ...	871.0	870.3	83	44	75.3	54.6	65.1	65.9	64.0	58.9	74	55	5.5	1.00	0.6	8	4,436
Gwelo	864.6	...	81	45	74.8	55.3	65.0	65.5	63.4	59.4	79	57	6.8	1.14	0.7	8	4,632
Riverbank ...	...	...	86	47	80.1	55.8	68.0	68.0	65.4	60.0	73	57	...	2.13	0.6	8	4,100
Essexvale ...	...	...	93	47	82.2	56.5	69.3	67.4	63.3	59.7	81	57	..	1.65	0.5	5	3,828
Gwanda ...	908.9	...	89	50	77.9	57.2	67.5	...	68.3	62.2	71	58	3.9	1.20	0.5	5	3,235
Mazunga ...	950.8	951.1	98	49	87.0	58.9	72.9	72.2	73.2	64.3	61	59	5.4	0.17	0.6	2	1,970
Nuanetsi ...	...	...	97	49	85.7	59.5	72 6	..	70.8	65.0	73	62	5.9	0.28	0.6	6	1,630
Between Rivers	...	...	87	49	81.4	56.7	69.0	...	65.3	61.7	82	60	5.1	1.48	1.7	7	3,970
Enkeldoorn ...	...	...	80	45	74.4	54.8	64.6	64.6	63.3	59.2	77	56	5.6	2.00	0.7	9	4,720
Gatooma ...	...	...	83	46	79.6	56.5	68.0	69.2	67.0	61.6	74	58	4.1	1.97	0.8	8	3,850
Miami	...	...	82	55	78.5	58.5	68 5	...	66.0	62.0	80	60	4.9	1.71	1.3	11	4,090
Salisbury ...	856.8	856.9	81	46	76.5	55.0	65.8	65.5	65.3	58.8	68	55	5.0	2.77	1.0	13	4,890
Sinoia, Citrus ...	...	...	83	52	79.6	57.5	68.5	...	65.5	61.5	80	59	...	1.35	1.6	7	3,830
Sipolilo... ...	...	...	84	53	77.2	58.9	68.0	...	68.2	61.5	69	58	4.1	1.74	1.3	9	3,900
Mtoko	...	...	83	51	76.5	57.6	67.0	...	66.5	60.9	73	58	4.1	1.69	0.5	6	4,210
Shamva ...	...	...	86	52	81 0	59.4	70.2	...	69.3	64.2	76	62	3.8	1.53	1.3	5	3,170
Angus Ranch ...	...	...	91	53	81.6	61.9	71.8	70.4	70.4	65.3	76	63	...	0.13	1.2	4	2,300
Craigendoran ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3,430
New Year's Gift	...	...	89	56	78.8	59.0	68 9	...	66.4	61.9	78	59	...	1.24	0.7	10	2,700
Nyamasanga ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5,080
Riverdene North	...	...	88	43	79.2	54.2	66.7	...	63.9	60.6	83	59	...	0.55	0.7	9	3,700
Stapleford ...	...	...	76	40	67.2	51.5	59.3	...	60.3	57.4	83	55	6.2	5.88	3 0	20	5,450
Umtali	895.0	894 9	86	50	72.9	58.0	65.5	66.2	67.7	62 4	74	59	5.6	1.81	1.0	9	3,677
Victoria ...	898.1	898.3	85	46	76.8	55.6	66.2	65.0	66.7	61.4	74	58	4.2	0.58	0.6	6	3,570
Manchester ...	...	...	76	48	68.4	53.9	61.1	...	56.5	55.6	94	54	...	4.51	...	16	...
Melsetter ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5,060
Mount Selinda	...	...	86	52	72.8	58.1	65.4	...	61.4	61.2	84	59	5.7	1.64	3.4	9	3,520

DEPARTMENTAL BULLETINS.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

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No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.

No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

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REPORTS ON CROP EXPERIMENTS.

No. 608. Annual Report of Experiments, 1924-25, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.

No. 631. Bulawayo Experiment Station : Annual Report for Year 1925-26, by H. W. Hilliard.

No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

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No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.

No. 688. Report, 1923-24—1926-27, Gwelo Municipal Demonstration Stations, by D. E. McLoughlin.

No. 716. Report, 1927-28, Gwelo Municipality Demonstration Stations, by S. D. Timson, M.C., Dip.Agric.

No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.

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No. 789. Agricultural Experiment Station, Salisbury : Annual Report of Experiments, 1928-29, by H. C. Arnold, Manager.

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No. 806. Gwebi Demonstration Farm, by the Chief Agriculturist.

No. 810. Gwelo Municipal Demonstration Station: Annual Report, 1929-30, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

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No. 851. Bulawayo Municipal Demonstration Station: Final Report, 1932, by D. E. McLaughlin, Assistant Agriculturist.

TOBACCO.

No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.

No. 615. The Culture of Virginia Tobacco in Southern Rhodesia—Field Management, by D. D. Brown.

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No. 850. Pests of Stored Tobacco in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.

Handbook of Tobacco Diseases in Southern Rhodesia, by J. C. F. Hopkins, B.Sc., A.I.C.T.A. Price 3/6 post free from Accountant, Department of Agriculture, Salisbury.

LIVE STOCK.

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EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

The Bacon Industry.—In the March issue of this Journal it was indicated that an enquiry had been made into the bacon industry of the Colony and that a report was being prepared. An abridged copy of the Committee's report is published in this issue.

Certain figures which were supplied by factories for the confidential information of the Committee have been omitted. These indicate, however, that the cost of production of bacon varies considerably with the size of the turnover, and it would appear that economic production cannot be attained unless a sufficiently large number of pigs are handled during the year. At the present time, therefore, this would indicate that in the interests of the pig industry the manufacture of bacon should be concentrated in a small number of suitably located factories.

The report indicates further that before the bacon industry can be satisfactorily established, even to meet our

own requirements, there must be an improvement in the type of pig supplied to the factories, and that to enable an export trade to be profitably established, either in the form of pork or bacon, the costs of production must be considerably reduced.

It has been suggested that all farmers interested in this branch of the industry should organise themselves into a Pig Breeders' Association on the lines suggested in the report. This proposal will be submitted to the Agricultural Unions for their consideration; and if approved, it is suggested that an appropriate time to arrange the preliminary meetings would be at the time of the next Salisbury and Bulawayo Shows.

If this could be done and a small executive committee appointed, the Department would be glad to assist such a committee in every possible way.

Charcoal from Rhodesian Woods.—Probably owing to the interest which is now being taken in farm power from gas producers, numerous enquiries have been received recently in regard to the preparation of charcoal from local woods.

An article has been prepared for this issue by Mr. R. J. Allen, the Forester to the Rhodes Matopo Estate, which will, we feel sure, be welcomed by farmers generally.

It should be noted, however, that experiments so far conducted with our local woods indicate that it is desirable to remove the bark from the wood before burning, otherwise the ash content of the resulting charcoal is likely to be unduly high.

Analyses are now being carried out on a number of the native timbers of this Colony with a view to determining their relative charcoal and ash contents. As soon as these are completed the results will be published in this Journal.

Sudan Grass for Seed.—The Division of Plant Industry of this Department wish to bring this subject to the notice of farmers, particularly those of the southern part of the Colony.

Sudan grass, having proved itself such an excellent host to induce the germination of witch weed, and the efficacy of trap-cropping as a means of control having now been so well proved, it follows that for the next few years there is likely to be a considerable demand for seed of this crop.

But cost of seed is an important consideration, and the more cheaply it can be produced or offered for sale the greater the inducement to make use of it. Sudan grass seed has recently been offered in the Union at 3½d. per lb., but when exchange and railage is added, the selling price in Rhodesia will probably amount to between 5d. and 6d. per lb. Twelve to 16 lbs. of seed is recommended to be sown broadcast per acre for trap-cropping purposes, and two trap crops should be sown and ploughed under in the season. Considering the great effect such treatment exerts, both in suppressing witch weed and in restoring fertility, the expense even at this price for seed is not excessive, but it will be all to the good if cheaper supplies of seed can be made available.

As a hay crop Sudan grass has not gained any great measure of popularity in Rhodesia—firstly owing to the plentiful sources of veld grass for conversion into hay, and secondly owing to its susceptibility to a leaf disease, downy mildew (*Sporospora graminicola*), which during continuous wet weather causes great injury to the foliage, and thereby reduces the vitality of the plant.

Past experience, however, has shown that reasonably good returns of seed can be produced in Rhodesia, and yields of 300 to 400 lbs. per acre have not infrequently been obtained. At a selling price of 3d. to 4d. per lb., apart from the question of growing for one's own use, the crop offers moderately good prospects as a side-line.

Better results are recorded with Sudan grass from the Bulawayo Demonstration Station than from the Salisbury Station, the dryer conditions of Matabeleland offering less inducement to the spread of the leaf disease previously referred to. It would therefore appear that the production of Sudan grass seed might well receive the special attention of farmers in Matabeleland, the Midlands and in the Fort Victoria area.

Seed can also be produced in Mashonaland, but in this case it is advisable to postpone sowing until about the middle of January. If leaf disease becomes serious during the early stages of growth, a mowing machine should be run over the crop, and a second vigorous growth more free of the disease can then usually be expected.

The crop requires about four months to mature, and date of seeding should be regulated so that the greater part of the crop's growth may be made after the heavier rains are over. The plant is extremely drought-resistant, and will usually continue vigorous growth for several weeks after rains entirely cease.

Sudan grass is sensitive to frost, and cannot therefore normally be grown in winter; however, as a seed crop, it is deserving of trial under irrigation in frost-free areas. In this case it should be sown not later than the middle of July.

Ten pounds of seed per acre is sufficient when a seed crop is the objective, and the seed should be sown fairly thinly in continuous drills about 18 to 20 inches apart, using a maize planter fitted with kaffir corn plates and splitting the rows. A moderately but not excessively fertile soil should be chosen for the seed crop.

Chilled Meat.—The recent consignments of chilled beef from the Union may mark an epoch in the beef trade of South Africa.

These successful shipments of chilled meat were sent from Johannesburg and from Capetown, and, though the reports indicate that the butchering could be improved upon and that the animals were on the old side, the trade was apparently well satisfied with the consignments.

The net returns of the producers are not available yet. The meat, however, sold comparatively well. An average price of about 4d. per lb. was realised, which indicates that there is a fair market even to-day in the United Kingdom for our best class of cattle as chilled beef.

The development is of great interest to Rhodesian farmers, as nine Lightfoot-Stone refrigerator trucks, which are

capable of conveying chilled beef to Capetown, will be available by the end of the year. As soon as veterinary restrictions on the transit of meat are removed, these trucks will, therefore, provide a means of export for similar consignments of meat from Rhodesia.

An article on the general export situation appears elsewhere in this issue.

Field Control of Angular Spot of Tobacco.—It has been found on the Tobacco Research Station, Salisbury, that applications of Bordeaux mixture to young field plants affected by angular spot gives good control of the disease, provided that all leaves, both visibly infected and apparently healthy, are primed off leaving only the bud before spraying takes place. This method of control was recorded in the departmental handbook "Diseases of Tobacco in Southern Rhodesia," but confirmation on a field scale had not been obtained.

It is, therefore, of considerable interest to find that successful prevention of an epidemic of angular spot has been accomplished by Mr. Hansen, of Dedsi Farm, Sinoia, using only locally obtained Bordeaux mixture and spraying outfit.

Mr. Hansen has kindly reported fully on the results obtained by him, and has given permission for the following extract from his letter to be published in this Journal:—

> It is with great pleasure I forward a report on the control measures I employed in combating this disease with very satisfactory results.
>
> On receipt of your promptly dispatched wire of 14th January, I at once proceeded to prime the tobacco, which at that time had been planted out twenty-six days. In priming everything was removed, leaving just the bud; all leaves were, of course, taken right away from the land and destroyed. Directly following the priming a gang of four natives followed with an ordinary spray pump, arranged as follows: Two natives carrying a five-gallon dip drum on a pole slung from the shoulder by "tambo," one of these stirring the Bordeaux mixture continually, one native pumping and one native directing

the spray on to each plant. A good pressure was kept up, enabling the natives to walk as fast as possible. In this way the spraying gang covered seven acres, or nineteen miles, per day.

The ordinary commercial Bordeaux mixture was used. To facilitate the mixing, all the powder was made up in ten-ounce packets, one of these to five gallons of water giving the correct strength.

As to quantities, two pounds of powder were needed to spray one acre.

Cost per Acre.

2 lbs. Bordeaux mixture at 11d.	1	10
4 natives at 1s. per day	0	7
Total	2	5

The cost of priming and removing leaves not reckoned, as this is ordinary field practice.

Results.—Plants grew out to normal size, with fourteen to eighteen useful leaves, no sign of angular spot at all, and plants free of any blemish till 8th March, when frog-eye made its appearance, owing to the very wet weather experienced at that time.

It was noticed that plants suffering from visible mosaic infection at time of maturity were less than one-half per cent.

In conclusion, I should like to express by sincerest appreciation of the promptitude with which the diagnosis of the leaves was made, enabling me to start the preventive measures during a fortunate spell of dry weather.

DATES OF AGRICULTURAL SHOWS, 1932.

Plumtree	18th June
Umtali	22nd & 23rd July
Bindura	30th July
Salisbury	24th & 25th August
Bulawayo	1st & 2nd September

THE CATTLE INDUSTRY.

By Dr. A. E. Romyn, Senior Animal Husbandry Officer.

The future of the cattle industry in Southern Rhodesia lies in a stern and vigorous policy of improvement in quality.

There are close on two and a half million head of cattle in the Colony, but, with the possible exception of a quarter of a million head, they are all of a type which, under ordinary circumstances, could only be absorbed profitably on the local market. At present, however, this local market is in a position to absorb approximately half of the annual output of cattle—the rest is surplus.

Great Britain is the only international market of importance in the beef trade to-day. For various reasons the smaller markets in Europe and the East do not appear to hold out much prospect for this Colony at present, but, as England absorbs approximately four-fifths of the chilled beef moving into international trade, and half of the frozen beef, there should be room there for any quantity of beef Southern Rhodesia could produce. It must, however, be realised that this market will not interest itself seriously in our products until we can guarantee both the quality and the regularity of our supplies—and the trade must be organised on lines which will ensure these requirements.

The Scrub.—At present the so-called "scrub beast" is the predominant type produced in this country. Generally speaking, this type of beast can be exported only as frozen beef. Unfortunately, however, the demand for frozen beef in the world is contracting, and the prices for it usually do not allow the producer a margin of profit when normal capital expenses are taken into account. There is no reason to expect a very vast improvement in this respect in the future.

The producer of the scrub animal who hopes to make a living from cattle farming has, therefore, two courses open to

him. He can either limit his production to the demands of the local market or he can improve his cattle so as to take advantage of the chilled beef and live cattle export trades, which yield much better returns than the frozen meat market.

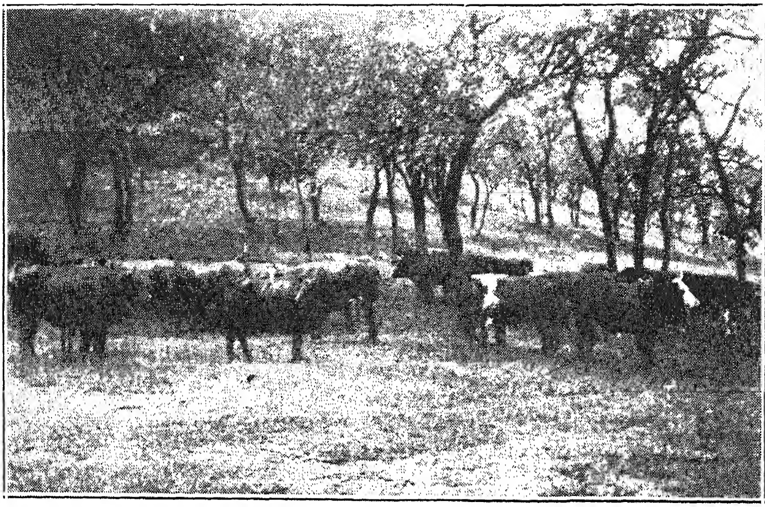
The course of limiting production to the local market is not likely to be a success. A certain steady demand for many years to come for compound and native meat seems assured, but the market is already over-supplied, and it is likely that it will always be dominated by the native beast and cull dairy stock.

Improvement in quality, therefore, is essential, and though prices may not be profitable in the transition stage, when the cattle are too good for the local market but not sufficiently good for the chilled meat or live cattle trades, there should be a fair market for the intermediate grade of cattle as frozen beef of an average quality in the United Kingdom for some time to come. There is also a good deal of comfort in the old saying, "half the breeding of a beast goes in at its mouth," and, if the improvement in breeding is accompanied by a determined effort to improve the feeding of the beast, the transition stage will be much shorter than is commonly anticipated.

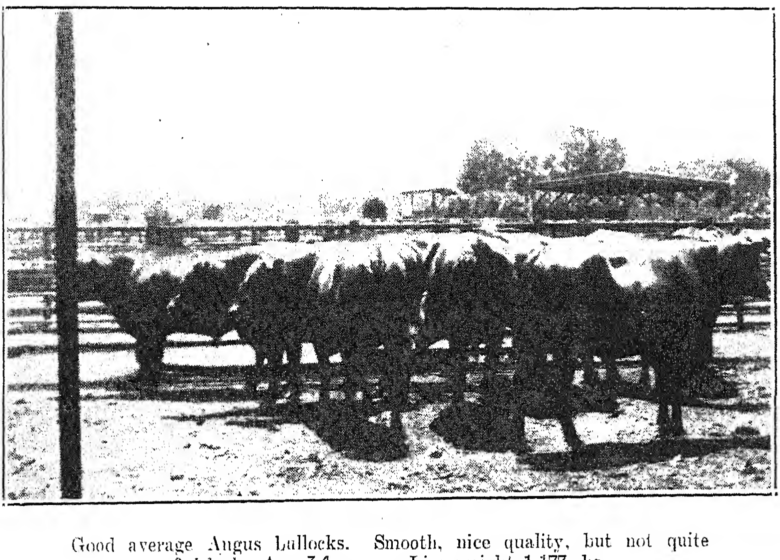
The Improved Steer.—The prospects for the better grades of cattle are more promising. The present outbreak of foot and mouth disease has clouded the issue, but there are no fundamental reasons for doubting the future of the Colony for the production of cattle. Land is cheap and the country is suited for the production of beef. An upward trend in beef prices in relation to dairy products is expected when conditions return to normal, and there are hopes of an Imperial preference or quota.

Facilities for export exist, and once veterinary restrictions are removed, there is little doubt that a demand for Rhodesian beef could be created in England *if farmers could guarantee a regular supply of the quality of cattle required.*

Chilled Beef.—The aim of producers is to develop an export trade in chilled beef. The recent exports of chilled beef from the Union may therefore mark an epoch in the meat trade of South Africa. The preliminary reports on these consignments are encouraging and indicate that, with the co-



Well-finished grade Hereford bullocks. Some too old. Age 4-6 years
Live weight 1,253 lbs.



Good average Angus bullocks. Smooth, nice quality, but not quite
finished. Age 3-4 years. Live weight 1,177 lbs.

operation of our neighbours in the South, viz., Bechuanaland, South-West Africa and the Union, it should be possible even now to launch a limited trade in chilled beef.

There are comparatively few steers in South Africa to-day of the quality required to meet Argentine competition, and the question has been raised as to whether the Colony can ever produce any quantity of the grade of chilled beef exported from the Argentine. The answer seems to be in the negative, but there is not much doubt that a grade of beef could be produced in comparatively large quantities which would be acceptable on the Home market and would leave the producer a fair return for his efforts.

In almost all cases some supplementary feeding would be necessary, but, with a fairly secure prospect of obtaining a net return of not less than 25s. per 100 lbs. dead weight, which is not an unreasonable anticipation, breeders should be able to turn out a considerable number of good to very good medium steers comparable, perhaps, with the average run now exported from Uruguay, and acceptable on the English market.

Legislation.—There is so much of a tendency to "wait and see" what the market will do and to hang back for an assured profitable outlet before doing anything, that it may be doubted whether the present generation of farmers will get down to the task of cattle improvement and persevere through the intermediate stages without some legislative compulsion. The fact seems generally to be overlooked that there are ample lands elsewhere in the world which are now producing beef for the English market, and that this Colony will always have to meet keen competition, as any improvement in the price of beef would stimulate production in these countries as well as here. The psychological time to get into the market would therefore appear to be *now*, when breeding stock is cheap and when other countries are decreasing their beef herds or changing over to dairying—to which latter industry a considerable part of this country is not well suited.

Two measures seem essential to hasten the rate of progress. These are:—

(a) The inspection and licensing of bulls, with the compulsory castration of undesirable sires.

(b) The payment for cattle on a basis of live weight.

Legislation in respect of the licensing of bulls has been introduced in Ireland, and in respect of weighing of cattle in the Argentine. Both countries are predominantly dependent on the English market, and in both countries authorities attribute the improvement which has taken place in the quality of the cattle and beef exported to a large extent to these measures. Cattle owners in the Union are pressing for similar regulations at the moment.

The use of well-bred bulls is only the first step towards the improvement of a herd. Conditions must be improved to enable these bulls to do themselves justice. A good bull under scrub conditions may do more harm than good to the herd, and under supervision made possible by a system of licensing bulls and the availability of weight and price records not the least benefit would be the possibility of bringing into operation a definite breeding and management policy for the various areas in the Colony.

A lead could also be given in many economic problems. For instance, the fattening of steers for export as chilled beef or as live cattle could be properly organised. At present there is no regular contact between the ranchers in the south, who can produce steers cheaply, and the agricultural farmers in the north, who need the steers to convert part of their maize crop into beef. Systematic arrangements should be made, either to bring the cattle to the feed or the feed to the cattle, whichever in the circumstance proves the most economical of effort and transport.

There are also some areas where, on account of the difficulty of providing winter feed and the low value of the grazing during the dry months, it may not be advisable to keep steers longer than the weaner stage. Ranchers in these areas should be induced to dispose of calves to feeders in parts more favourably situated for the production of supplementary feed, or, possibly, to export these calves direct as frozen "veal" to England, if the trial shipment to be made shortly is as successful as its organisers hope.

The Export of Cattle on the Hoof.—The export of chilled beef has been indicated as the objective of the cattle farmer. It should, however, be pointed out that at the beginning the cheapest way to export cattle may be on the hoof on account

of the relatively heavy expenses in the chilling and transport of meat when a small number of cattle only is handled. It is likely, therefore, that the export of cattle on the hoof, which was cut short by an outbreak of foot and mouth disease in April, 1931, will be resumed when veterinary restrictions are removed.

The fortune of this trade since it was started by Mr. J. R. Stewart in 1925, has been a fluctuating one. Since that year there have been 10 shipments totalling 2,500 head of cattle. It has been necessary to assist the trade by a bounty, as the returns from these cattle have, on the whole, been smaller than the values they would have realised on the Johannesburg market at the time they were exported. It seems too optimistic, however, to anticipate a return to the prices which ruled at Johannesburg for this type of Rhodesian cattle two years ago, and farmers will perforce have to pay more attention to this trade in the future. The magnitude of the trade can be gathered from the fact that in 1931 Great Britain imported 739,000 head of cattle on the hoof from the Irish Free State, valued at £12,900,000, and 27,000, valued at £554,000, from Canada.

It has still to be determined whether it will be more profitable to export two- or three-year-old steers which have been intensively fed, or older cattle which have been grown out more cheaply and then fattened. The determining factor will be the cost of transport and marketing in proportion to the price paid per lb. for different weights of the steers. It should not, however, take the industry long to learn which is the more profitable type to export.

The two illustrations show the type of bullock shipped in the last consignment per the S.S. Clan Morrison, and should be of interest in this connection.

The two lots shown sold at above the average price for the consignment, but were faulted at Smithfield as being too aged and on the heavy side.

The disadvantage of shipping a light bullock lies in the fact that it pays the same transport and marketing charges as a heavier animal, and, in the past, has not sold at sufficiently more per lb. to compensate for the relatively heavier cost in getting it to market.

In the Clan Morrison consignment the best prices per 100 lbs. live weight were made by bullocks weighing about 1,100 lbs., but the best financial returns were given by bullocks weighing over 1,400 lbs. The criticism in regard to weight and age should be borne in mind, but it is likely that until freight rates are reduced, the tendency will be to continue to ship comparatively heavy cattle.

Summary.—To summarise these views, one might say that, given the necessary ambition, there is every reason to believe that the raising of beef in Rhodesia could be made a considerable and profitable industry.

The key to the position is improvement in quality. Those producers who improve their herds can look to a fair market in the United Kingdom. The producer of scrub cattle has, however, little to look forward to. He acts as a dead weight on the local market and retards the expansion in the number of better cattle, which is necessary to maintain a trade with the English market. For his own good, therefore, and for that of his country, he should be forced, by legislative means if necessary, to improve his cattle.

Perhaps the newly-formed Cattle Owners' Association will take the lead in creating the atmosphere necessary to get things moving. The present depression is as much psychological as economic.

TWENTY-ONE YEARS OF PLANT INTRODUCTION AND TRIAL IN SOUTHERN RHODESIA.

By H. G. Mundy, Dip.Agric.(Wye.), F.L.S.,
Chief, Division of Plant Industry.

To the founder of the Colony, Cecil John Rhodes, is due the credit for the first deliberate introductions of plant material with the object of ascertaining the agricultural possibilities of Southern Rhodesia. Mr. Rhodes' interest in agricultural development was intense, and as is evidenced by his will, one of the main reasons for developing his extensive estates at Matopos and Inyanga was to ascertain the farm crops, fruits and forest trees best adapted to local conditions.

In December, 1896, lucerne seed was sent by him from Port Elizabeth for trial under irrigation at Matopos, and the following year he imported from Australia a number of varieties of orange trees and also saltbush for experimental propagation on the same estate. Simultaneously Mr. Rhodes introduced to the Inyanga Estate a wide selection of apple, peach, plum and apricot varieties. In 1900 he gave thought to afforestation, and in that year a commencement was made in laying down plantations of cypress, pine, eucalyptus and wattle at Inyanga, while initial trials were also made with paspalum grass and sheep's burnet.

These experiments were conducted under the supervision of Mr. J. G. McDonald (now Sir James McDonald), who between the years 1909 and 1913 published valuable information on the results obtained therefrom in his several editions of "Hints to South African Farmers." The same gentleman has kindly given the writer the following brief but interesting record of Mr. Rhodes' discovery of the valuable pasture and hay grass which since then has universally borne his name:—

"It was in 1896 that Mr. Rhodes noticed a grass growing in the greenstone-schist kopjes (not granite) on the Sauerdale and Westacre Estates (near Bulawayo) which he observed that stock were particularly fond of. He arranged that roots of this grass, and later seed when available, should be sent to him at Capetown. This was done; the grass was further propagated at his residence Groot Schuur, in the Cape, and from this began the world-wide distribution of Rhodes Grass."

Seed and plant introduction and distribution was maintained on a limited scale by the Department of Agriculture during its early existence under the administration of the British South Africa Company, but as far as can be judged from the records available new introductions, apart from maize varieties and forest trees, were only made from Southern Africa.

In 1909 the Department was re-organised, and with the appointment of the writer in the capacity of Agriculturist and Economic Botanist, and with the opening of the Botanical (now the Agricultural) Experiment Station, Salisbury, providing suitable trial grounds, the work of plant introduction became one of the primary functions of that station. During the first two years, 1909-1911, the station concentrated on variety trials with those crops already known or reported to grow well or moderately well in the territory, and not until this preliminary survey had been undertaken were more diversified field experiments, accompanied by a wider range of plant introductions, commenced.

It is hardly less important to know the crops and varieties which can be grown in a country with success than it is to know those which cannot be so grown. Knowledge on both points is essential if the individual farmer is to be saved much unnecessary expense and wasted effort. Plant introduction has therefore been continued systematically since the above date, and during the intervening period many thousands of introductions have been made, some aiming at procuring strains of wheat and oats sufficiently rust-evading to be grown as summer crops, some in order (if possible) to secure pasture plants capable of growth and remaining green during the dry winter, others to introduce varieties more resistant to disease or insect pest or capable of affording higher yields

per acre, and yet others to enlarge the range of marketable crops or foodstuffs for home use which the Colony may produce.

With few exceptions, the standard strains of seed grown in Rhodesia to-day are the result of these introductions and eliminations made on the Salisbury station during the past twenty-one years. Examples are the white stingless and osceola velvet beans, brown dolichos bean, Sunn hemp, oat selections adapted to growing in summer, Sudan grass, the winter wheat varieties now in favour, sunflower, certain varieties of lucerne and clover, bush and other improved types of cowpea, sweet potatoes, edible canna, soya beans, dhal, Napier grass, kudzu vine and sundry other crops, as also to a lesser degree the varieties of maize and potatoes now grown. But while many introductions—several further improved by subsequent selection—have been attended by marked success, far more not unnaturally have given more or less negative results, and it is with the latter that the present record will principally deal.

The methods followed have been to grow each introduction for at least two years on small plots of one-fiftieth of an acre or less in area. When results have justified such a course, cultivation has then been extended to larger plots for a further period of years, and on these plots, and sometimes on other Government farms, acclimatised seed has been bulked up for issue to farmers under terms of co-operative experiments. Planting material has thus been disseminated through the Colony, and in a comparatively short period the apparently more promising introductions, varieties or selections have either established themselves as common crops of the country or have been discarded.

Apart from actual introductions from other countries, a large number of native (indigenous) grasses and other plants have also been grown under cultivation in order to study their suitability as pasture or browse plants, as sources of fibre, as legumes for fodder and green manuring, or in a few instances as plants of apparent pharmaceutical interest.

According to their characteristics and probable needs and possibilities, plants have been tested as dry-land crops under summer rainfall conditions, as irrigated winter crops,

or as crops grown under the summer rainfall and maintained by irrigation during the winter. Unless the individual has shown definite signs of promise, its trial has often been confined under the above conditions to the red clay loams of the Salisbury station, but not infrequently crops of considerable economic importance have been further tried out on other soils and at other altitudes.

In a number of cases results are of an indefinite nature, due to growth or yield being only partially satisfactory, or to there being no apparent economic outlet for the product. In the former of these instances it is possible, though not considered probable except where stated, that some of the plants may eventually prove themselves better adapted to the conditions of soil, altitude and rainfall pertaining to other parts of the Colony.

This record omits for the most part any reference to the behaviour of the many pasture grasses and clovers, and all reference to the various strains of wheat, oats, barley, rye and tobacco, which have been experimented with. It deals therefore with only a small fraction of the actual introductions which have been made.

In the case of the grasses and clovers, information has been obtained regarding the conditions which they are unable to tolerate, and they are now in process of being exhaustively tested under what are regarded as the optimum conditions which the Colony can afford. The more promising survivals of the wheats are receiving the attention of the Government Plant Breeder with a view to further improvement in respect to rust resistance, yield and quality. The testing out and pure line segregation of tobacco varieties and strains is in progress on the Tobacco Research Station, and similar work on oats and soya beans—which has already eliminated a number of the less desirable features in the more suitable strains of these crops—is being continued on the Agricultural Experiment Station, Salisbury. As far as barley and rye are concerned, no introductions have yet proved better suited to local conditions than Cape six-row barley and Cape early rye.

LEGUMINOUS PLANTS.

ALYSICARPUS (*Alysicarpus sp.*).—A semi-prostrate native legume prevalent on black vlei soils, which, under such

conditions, may prove of value as a herbage plant. Apparently not very palatable to live stock, and is not recommended for dry soils. *A. rugosus*: A common leguminous weed of India, more upright in habit of growth, has been introduced, but has so far shown no great promise. The same species is native to Rhodesia but is of more prostrate character than the Indian type.

AMBERIQUE BEAN (*Phaseolus helvolus*).—Grows well as a summer crop on fertile, well-drained land. It yields a reasonably heavy crop of hay of fine quality, which is easily cured. Requires a long growing season and is very sensitive to frost; often behaves as a biennial and seeds well in its second season. Very liable to attack by leaf-eating beetle and by stem maggot and stem weevil, and, on the whole, is not as hardy or as heavy a yielder as dolichos and velvet beans or cowpeas.

ASTRALAGUS (*Astralagus sinensis*).—Climatic conditions appear unsuitable to this crop, which has invariably failed to develop any vigour of growth.

BAMBARRA GROUND-BEAN (Syn.: Earth nut. Nat.: N'Yemo.) (*Voandzeia subterranea*).—A pulse crop of the African native; good drought resister but a small yielder, and does not appear worthy of European cultivation.

FLORIDA BEGGAR WEED (*Desmodium tortuosum*).—This useful legume grows readily from seed and seeds profusely. At one time great expectations were had of the plant, but after repeated trial it has proved unable to maintain itself on any land on which established, though volunteering with much frequency for a year or two on adjoining ploughed land and sometimes in the natural veld. Other varieties of this plant of the giant type which have been tried are: *D. rensoni*, *D. leiocarpa* and *D. rhytidophyllum*. These species are too tall-growing and coarse for hay or green manuring, and appear unable to tolerate repeated cutting for green forage. They may possess value as shade bushes and "lopping" legumes for coffee plantations and tea gardens.

BERSEEM (Syn.: Egyptian clover) (*Trifolium Alexandrinum*).—This annual legume has proved of no value in Rhodesia as a rainy season crop, but may eventually find a

place under irrigation in the warmer areas as an annual, winter hay or green soiling crop. It has occasionally given fairly heavy yields (up to three cuttings) of fodder under suitable conditions.

CALOPOGONIUM (*Calopogonium muconoides*).—Introductions have failed to grow satisfactorily. Requires a very long growing season and has been killed by frost before much growth has been made or seed set.

CAROB BEAN (Syn.: Locust bean) (*Ceratonia siliqua*).—Only grows moderately well at the higher elevations and fruits but sparingly. Is said to do better at the lower altitude of Umtali, where yields of 900 lbs. of beans per tree of 9 years old and over have been reported. Extended cultivation does not in general appear warranted.

CENTROSEMA (*Centrosema pubescens*).—A green manure and cover crop of Ceylon. Conditions in Rhodesia are insufficiently tropical to suit this plant's requirements, and it does not mature seed here.

CLITORIA (*Clitoria cajanifolia*).—An upright, bush-like plant employed in Ceylon for green manuring and cover cropping. Grows well, but its woody growth and branched habit renders it unsuitable for general green manuring purposes in Rhodesia. May find a place in coffee and tea gardens.

CROTALARIA (*Crotalaria spp.*).—Many species of Crotalaria have been tested, including the indigenous *C. montana*, *C. maxillaris* var. *intermedia* and *C. lanceolata*, *C. sphæricarpa*, *C. natalita* and *C. stewartii*. None of these equal the true Sunn hemp in vigour or value as green manure crops. *C. anagyroides*, *C. striata* and *C. usaramoenis* have been introduced for trial. The first and second of these grow very slowly in the early part of the season, but eventually form vigorous bushy plants which, however, do not commence to flower until late summer or early winter. They are too slow growing and too branched to be suitable for green manuring in this Colony. *C. usaramoensis* is claimed to be resistant to nematode. It requires a longer growing season than *C. juncea* and possesses the disadvantage of dropping its earliest matured seed pods before the later produced pods are ripe.

DAINCHA (*Sesbania aculeata*), also the indigenous species *S. microphylla*, *S. tetraptera*, *S. cinarescens* and *S. cærulescens*. Apart from colour of flower, Daincha and the two native species are similar in habit of growth and thrive best on wet valley soils, which comprise the sole natural habitat of the native species. Germination and growth are very irregular; the stems are much coarser and more woody than those of Sunn hemp, and none of the species have proved as suitable as the latter for green manuring. Daincha and the two native types if sown thinly produce straight sticks of some value for hanging tobacco on in the curing process.

A type might perhaps be developed which would be of particular merit for the green manuring of wet vlei soils uncongenial to other legumes. The green leaves are browsed in autumn by cattle.

DHAL (*Cajanus cajang*).—Grows freely in all parts of Rhodesia and has some value as a temporary shade or summer hedge plant. Leafless in winter. Cattle do not relish the green foliage. The labour of reaping and threshing the crop is considerable, and the yield of grain is not heavy. Usually survives for two or more seasons. Might be made more use of as an auxiliary pulse crop, while the clusters of green pods and the young branches can be made into a palatable hay or may be ensiled.

FIELD PEA (COMMON) (*Pisum sativum arvense*).—This type of pea only succeeds in the cold months of the year. During the rainy season the plants suffer severely from white mould and mildew. One exception, namely, "Black-Eyed Susan," can be grown as a field crop in summer, but this variety is of poor quality for culinary purposes. Some success has been had with Yorkshire Hero as a garden crop in summer, but, in general, peas must be regarded as a cold weather crop to be grown under irrigation.

FISH POISON BEAN (*Tephrosia spp.*).—The varieties *T. vogellii* and *T. heckanniana* appear natives of Rhodesia. *T. candida*, *T. toxicaria* and *T. purpurea* have also been tested. The young leaves and flowers of *T. vogellii* are macerated by the natives and thrown into pools in which fish

are known to lie. After the water has been disturbed, the fish soon float to the surface in a stupefied condition.

These plants have some merits as garden ornamentals, but are useless as fodder plants, and owing to their bushy and woody growth, they are unsuitable as green manure crops. May be of use as lopping plants in coffee plantations and tea gardens. The pharmaceutical value, if any, of their chemical properties has not yet been fully investigated.

The Fish Poison Bean (*Tephrosia vogellei*).

GEMSBOK BEAN (*Bauhinia esculenta*).—A trailing legume which produces very large succulent roots. Makes little above-ground growth and does not seed in Rhodesia. Less valuable and more costly to harvest than sweet potatoes, edible canna and similar succulent crops, and not worthy of cultivation in this Colony.

GOAT'S RUE (*Galegia officinalis*).—A leguminous herbage plant. Does not succeed here on dry lands and seldom survives the winter, while making very little growth even during the rains. Under irrigation does not compare in value with lucerne and clovers.

GOTANI BEAN (*Canavalia ensiformis*, D.C.).—Similar to Jack bean; biennial, and sometimes longer lived. Colour of seed, white. Bush-like in growth, attaining a height of 18-24 ins. Although it has outyielded other beans, it cannot be depended upon to give a good return of seed for the first season, and is not as valuable for green manuring as several other legumes. Yields better in seasons of light rainfall than when rains are persistent; moderately tolerant of frost; very susceptible to attack by certain species of small beetles. If a biennial green manure crop of upright habit is required to replace dolichos or velvet beans, this crop may prove useful.

Apparently unpalatable to live stock in its green state and not much favoured when converted into hay or silage. The dry beans are said to be somewhat indigestible, though the green pods may be used as a substitute for French beans, and the immature seeds as a substitute for broad beans.

GRASS PEA (Syn.: Canadian wedge pea, Spanish lentil) (*Lathyrus sativus*).—Varieties *L.s. albus*, *L.s. azurea* and *L.s. coloratus* have been tested. These plants thrive moderately well both in winter and summer, but the yield of fodder is insufficient to warrant their adoption as field crops. Of some value to replace green peas in summer or as a substitute for dry peas for culinary purposes. Has given fair yields in some areas under irrigation as a winter legume for green forage or hay. By analysis, the hay has an exceptionally high feeding value.

GRAM (Syn.: *Chick-pea*) (*Cicer arietinum*).—Many strains have been tested, but the yield as either a summer or winter crop does not compare with that of many other legumes which can be grown. Does not seem likely to attain popularity in Rhodesia, though may possibly be grown in combination with oats as a winter forage crop.

GRAM: BROWN HORSE (*Dolichos biflorus*).—A creeping, fine-foliaged legume which covers the ground with a

thick mass of low-growing vegetation. The yield of fodder, however, is light, and the Rhodesian season is usually too short to allow of the maturing of any but a light crop of seed. Very sensitive to frost and much attacked by leaf-eating beetles. Should prove a valuable fodder crop in territories with a climate somewhat more tropical than Southern Rhodesia.

Indigofera endecaphylla.—The native species possesses some merit as a herbage plant. It attains a height of 6-9 ins. and is grazed by cattle and sheep. Does not seed freely, but growth in natural pastures appears to be stimulated to a marked degree by applications of artificial fertiliser.

Seed of the same species introduced from Ceylon has produced a more upright plant of straggling habit, attaining a height of some 15 ins. It seeds more freely and shows some tendency to root from the nodes of prostrate stems. The fodder has been eaten freely by mules. Appears to possess possibilities as a leguminous herbage plant for upland soils.

FIELD BEAN: COMMON (*Vicia faba*).—This class of bean only thrives as a winter crop in Rhodesia. To obtain a set of seed the top of the flower spikes must be pinched out soon after blossoming commences. If this precaution is adopted, garden types of this bean can be grown successfully as a winter crop under irrigation. Much attacked by aphides. Not a field crop. The tick bean, or horse bean, closely related to the above, will only grow under similar conditions of treatment, and the seed yield at the best is small.

JACK BEAN (*Canavalia sp.*).—Very similar to Gotani bean and producing a white seed, but the plant has a rambling habit of growth. The pods attain a length of 6-9 ins., with a width of ¾-1 in. The seed yield is uncertain, and the plant is too woody to be ideal for green manuring. The dry beans are said to be highly indigestible and occasionally poisonous.

The **SWORD BEAN** (*Canavalia gladiata*) is a pronounced climber producing even larger pods, which contain 6-9 large red seeds. The green beans are said to provide a palatable cooked vegetable with a mushroom-like flavour. Of no importance as a field crop in Rhodesia.

The climbing varieties, known locally as khaki Jack bean (*Canavalia obtusifolia* and *C. ferruginea*) occur wild in the Colony, but differ in no important economic aspect from the other species here referred to.

KUDZU VINE: RHODESIAN (*Glycine javanica*).—Is a fairly widely distributed native legume of the heavier soils of the Colony and is useful as a herbage plant. It does not, however, appear able to withstand heavy stocking, and makes comparatively small growth on pastures which are regularly grazed. *G. tomentosa* and *G. clandestinum* from Queensland have also been tested, but none of the three equal the Japanese Kudzu vine (*Pueraria thunbergiana*) in vigour or economic value in Rhodesia.

LENTIL: FRENCH (*Ervum ervilia*).—Useless as a summer rainfall crop. Thrives fairly well in winter but produces a very light yield of grain and fodder. Not likely to prove of economic importance here.

LIMA BEAN (*Phaseolus lunatus*).—The Rhodesian summer is rather short for the field types of this bean. Occasionally successful as a garden crop but not equal to other kinds of green beans in yield and hardiness. No marked success has been obtained with any lima bean on the Salisbury Station, though the bush lima shows some promise. Certain types may perhaps be developed as field crops if sown under irrigation before the rains commence, and thus given an extended growing season.

SEVEN YEAR BEAN or **PAINTED LADY** (*Phaseolus lunatus*, var., *macrocarpus*).—This is very closely related to the Lima bean, but is a most luxuriant climber; biennial and often long-lived. The seed is a dull brownish-red in colour on the small end and up to the edge of the hilum or "eye," with a few scattered spots of a similar colour on the remainder of the surface, which is white. Grown occasionally as a garden crop. The beans are said to be very palatable when cooked in the green stage, as a substitute for broad beans in summer. Not suitable as a field crop, and the colour of beans renders them unpopular on overseas markets.

LUPINS (*Lupins spp.*).—The varieties white, yellow and blue have been tested, but the crop only thrives to advantage

in late autumn. Early summer sowings usually fail, and later planted crops mature too late for ploughing under before the land becomes dry. May prove of value for autumn feed for sheep at altitudes above 6,000 feet, provided the rainfall at that period of the year is adequate.

MOTH BEAN (*Phaseolus aconitifolius*).—A procumbent type of bean for which the climate does not appear suitable. Does not attain a height of more than 6 ins., and would seem to be without economic importance to Rhodesia.

MUNG BEAN (Syn.: Green gram) (*Phaseolus mungo*).—Also Yellow Mung bean, *P. aureus*. This crop also appears unsuitable to Rhodesian conditions. Always severely attacked by Aphis, and not equal to cowpeas, soya beans, dolichos beans, etc., in vigour of growth and yield per acre. Perhaps better adapted to more arid areas, but has shown no promise on the Bulawayo or Gwelo Experiment Stations.

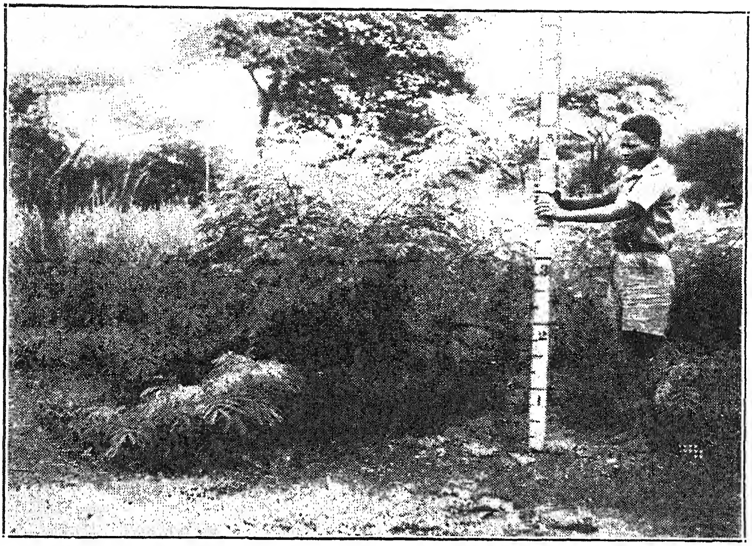
NAMBYQUARA GROUND NUT (*Arachis nambyquara*).—A very large-seeded type of ground nut introduced from South America. Requires a long growing season, and the climate of Rhodesia is too cold for it. May prove useful as a parent in plant breeding work on this crop where a large-kernelled type is the objective.

QUEENSLAND LUCERNE (*Stylosanthes mucronata*).—An annual legume common on the coastal slopes of Queensland and said to be a valuable herbage plant. Without irrigation it has failed to survive the dry months of winter, and would not appear worthy of a place amongst the irrigated pasture plants of the Colony.

SAINFOIN (*Onobrychis sativa*).—There is no record of this herbage plant having proved successful anywhere in Rhodesia. Soils are possibly too acid. Will not survive the dry winter unless irrigated, and under irrigation does not do as well as lucerne and certain of the clovers.

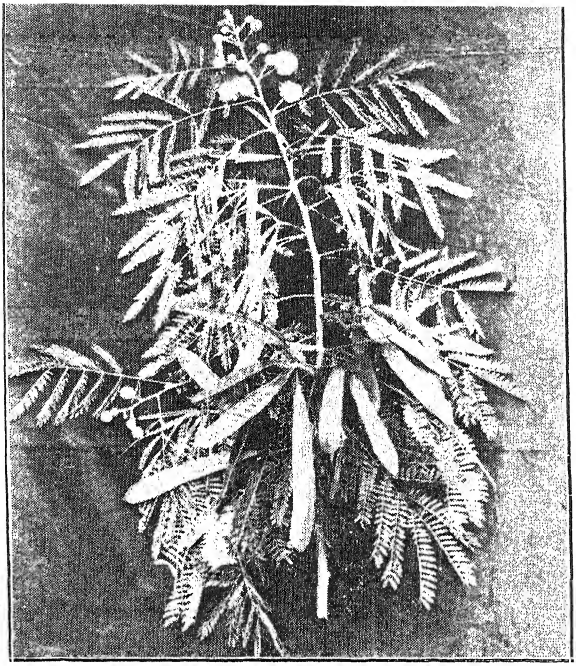
SERRADELLA (*Ornithopus sativus*).—An annual legume to which the same remarks apply as for Sainfoin, except in respect to soil acidity.

SOUR CLOVER (*Melilotus indica*).—Grows with great luxuriance on irrigated land, but is not equal to other melilots



Vi-Vi.--14 months' growth from the planting of the seed in January, 1931.

Locust Bean Tree.—Five years old from date of planting-out on [illegible]



Vi-Vi. Showing flowers and seed-pods.

as a fodder crop. Liable to become a troublesome winter weed in irrigated land which is constantly sown to cereal crops. In its green state is not palatable to cattle.

SULLA or **SULLA-CLOVER** (*Hedysarum coronarium*).—Same remarks apply as to Serradella.

TEPARY BEAN (*Phaseolus acutifolius*, var., *latifolius*).—A very quick-maturing bush bean producing a small white seed of the haricot type. Yields well, but the plant only attains a height of 6-9 ins., and is therefore laborious and costly to harvest. A good catch crop for sowing late in the season or under a restricted rainfall. Does well on virgin soil, and for some years enjoyed considerable popularity. Is not favoured on overseas markets, but produces a palatable dry bean for local consumption.

TREE LUCERNE (*Medicago arborea*).—Has not been grown with success on the Salisbury Station, and as a fodder plant is not usually relished by stock. One case is reported where the plant is cultivated successfully to provide green feed in winter for poultry. Is not considered worthy of attention except, perhaps, for the latter purpose. Benefits from winter irrigation.

VETCHES (*Vicia spp.*).—A large number of these have been tested, including *V. sativa* (common), *V. villosa* (hairy), *V. narbonnensis* (narbonne), *V. angustifolia* (narrow leaf), *V. dasycarpa* (woolly pod), *V. monantha*, *V. atropurpurea* (purple), *V. sitchensis*, *V. fulgens* (scarlet), *V. cracca*, *V. calcarata* (Bard) and *V. pannonica* (Hungarian). The vetches fall into that group of plants which will only grow readily in Rhodesia as winter crops. Under such conditions and given irrigation, they mostly do well, and also show some promise as winter crops on wet vlei soils. Combined with late-maturing oats to provide green fodder or grazing for sheep, they may later find a place amongst the general crops of the Colony. For these purposes the most promising varieties are:—*V. sativa*, *V. Villosa* and *V. atropurpurea*. "Crown vetch," *Caronilla varia*, recently introduced by courtesy of the United States of America, is undergoing preliminary trial. Its appearance is not that of a true vetch.

VI-VI (*Lucaena glauca*).—A small leguminous tree introduced from Queensland. In Rhodesia it attains a height of 6-14 ft.; is said to be a valuable browsing plant. Grows readily, seeds profusely and the young branches and seed-pods are freely eaten by stock. Seems particularly to like the Kalahari sandstone formation, on which type of soil it may well prove of value. In Queensland the fodder is said to contain as high a percentage of protein as 25.75 per cent. Seed should be steeped in hot water before sowing. Can be sown *in situ* or transplanted.

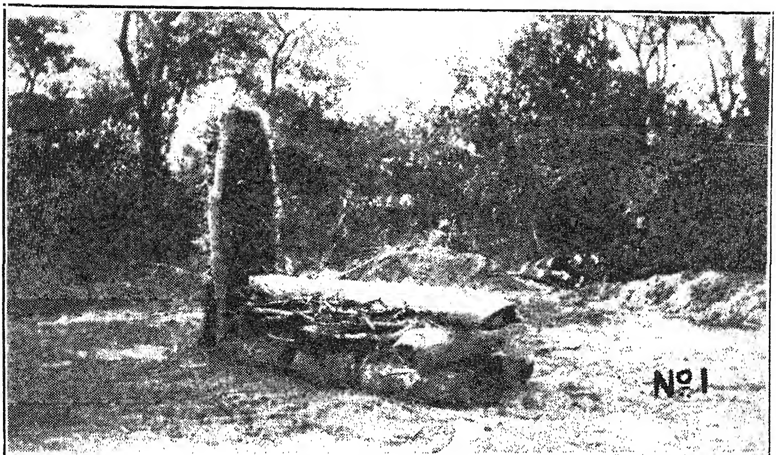
YAM BEAN (*Dolichos bulbosus*. Syn.: *Pachyrhizus tuberosus*).—Does not appear at home in Rhodesia. Seed has germinated well, but one plant after another for no observable cause has died off, until none have survived. Fruits very sparingly.

WOOLLY PYROL BEAN (*Phaseolus sp.*).—A procumbent type of bean which makes very little growth and appears to be without local importance.

(To be continued in next issue.)

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.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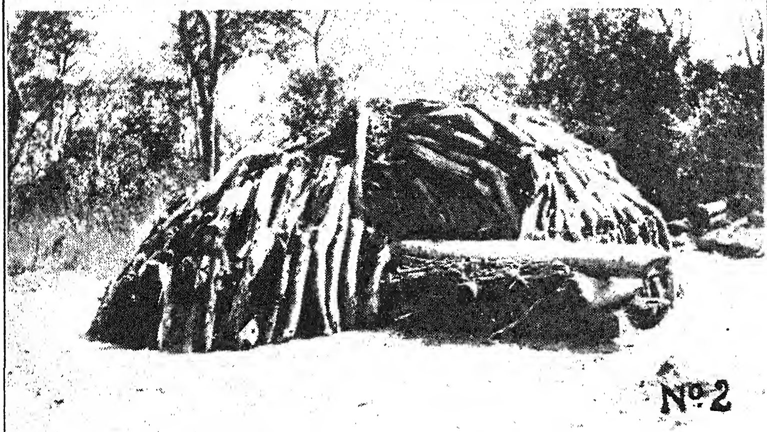
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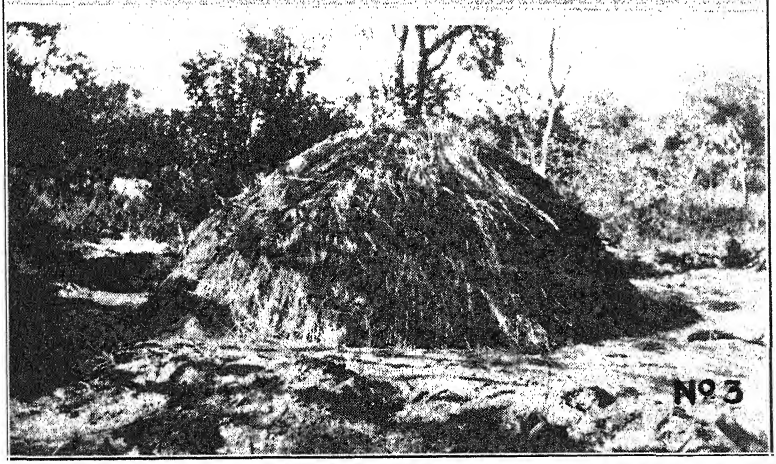
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No 4


No 5


No 6

CHARCOAL BURNING ON THE FARM

By R. J. Allen, Forester, Rhodes Matopo Estate, Matopo School of Agriculture and Experiment Station.

Wood charcoal may be used for numerous purposes on the farm. The chief uses to which it is put are:—It is a cheap source of power for running suction gas engines, smelting and smithy work. In a crushed form it is also fed to poultry.

Wood consists chiefly of the carbohydrate cellulose and lignin, and by burning or subjecting to a high temperature, without free admission of air, most of the organic substances can be driven off, leaving a residue of impure carbon called charcoal.

The manufacturing of charcoal is a very simple operation. There are two ways in which this may be done. These are:—(1) in a hole in the ground; (2) in a kiln.

The first is a time and labour wasting method. Even where wood has no value, it should never be employed. Half of it is burnt to ashes and cannot be used.

A hole is dug in the ground, four feet deep, six feet long and four feet wide. Dry grass and branches are placed in this and set alight. A quantity of dry wood is added and allowed to burn well. When this has been reduced to embers, more wood is placed in the hole and the process repeated until it is full of glowing embers. It is then covered with green grass and earth to a depth of twelve inches, and left for twenty-four to thirty-six hours to cool, before the charcoal can be removed.

Burning in a Kiln—Species and size of Wood used:—Some woods burn quicker than others, and for this reason only one kind should, if possible, be burnt in a kiln. Should two or more be burnt in the same kiln, it may happen that

the one has over-burnt or turned to ashes before the other is ready to be removed.

In the kiln shown in the accompanying photographs the kind of wood used was *Burkea africana* (umnondo or mukarati). The results were excellent.

The size of the wood varies in accordance with the shape of the kiln. In the illustrations is shown wood which was cut into lengths two feet long by three to six inches in diameter.

Shape and Size of the Kiln.—The shape of the kiln is that of a paraboloid, i.e., resembling a cricket ball cut in half.

In size, this is twelve feet in diameter at the base and four feet high. Before attempting to burn in kilns larger than this, one should first gain a little experience. This is best done by keeping to the size mentioned.

Construction of the Kiln—Flue and Firing Chamber.—Select a spot which is level and sheltered from strong winds. To construct the flue:—(1) Clear and level the ground; (2) describe a circle twelve feet in diameter; (3) cut three poles, each five feet long and three inches in diameter; (4) drive these one foot deep into the ground, twelve inches apart, in the form of a triangle in the centre of the circle; (5) within these poles place a layer of dry grass. On top of this place a layer of dry kindling wood; both these layers should be approximately one foot deep; add one layer of dry grass; fill up to the tops of the poles with dry kindling wood.

To construct the firing chamber:—(1) From two of the poles, forming one side of the flue, draw two parallel lines twelve inches apart, in the direction of the prevailing wind, to the edge of the circle; (2) cut nine pieces of wood, each fifteen inches long by nine inches in diameter; (3) lay three of these lengthwise, at intervals, on each of the two lines; across each of the three pairs lay one of the three remaining pieces; (4) cut a log five feet long by nine inches in diameter; place this so as to rest on top of the three crosspieces, the outside end being immediately above the circle; (5) in the enclosed space thus formed, pack as much dry grass and kindling wood as it will contain. This must connect up with the kindling in the flue.

Stacking the Wood.—Use only dry wood from which the bark has been removed. The wood is stacked in three tiers, completely enclosing the firing chamber and flue, the firing point and the top of the flue not being covered in. The larger pieces are placed in the centre of the circle round the flue. In the first tier the billets are placed on one end and stand erect. In the second tier the billets rest on top of those in the first and are inclined upwards, towards the flue, at an angle of about 60 degrees. On top of this is placed the third tier. In this the billets are laid flat.

All the wood must be packed as close as possible, and all spaces should be filled in with dry kindling wood, from which the bark must be removed.

Thatching.—Having stacked the wood, the next thing to be done is the thatching. This is done with green grass, or, if none is available, use grass which has been damped with water. The grass is not tied down, but is placed on loosely to a depth of six inches evenly, leaving none of the wood exposed. Commence thatching from the bottom and work upwards. This will prevent the tips of the grass from standing erect and enabling the earth covering to slide through in places. The top of the flue and the outside end of the firing chamber are left uncovered.

Covering with Earth:—

(1) To prevent its being stopped with earth, cover the top of the flue with a bucket turned upside down.

(2) Using three short, stout pieces of wood about ten inches in diameter, build an archway in front and round the mouth of the firing chamber to prevent earth sliding down.

(3) Commence digging three feet away from the base of the kiln and work outwards. The soil should be well pulverised and contain no stones or clods. With this, cover the kiln to a depth of two feet at the bottom, working up to the top, where it should not be less than fifteen inches thick. This must be well firmed by patting with a spade.

Firing the Kiln.—This is done at sunrise. First remove the bucket covering the top of the flue, and then set alight at the entrance of the firing chamber. It is necessary to keep a good fire going, and as soon as the material in the chamber

has been burnt out, more must be added. This must be kept up for at least three or four hours to ensure thorough firing. When this has happened, seal the mouth of the firing chamber and the flue with green grass, or green branches and earth. The kiln must now be watched. Where it shows cracks or has fallen in, beat the covering down and add more earth. Where it is not burning, lead the fire by making a hole in the covering about twelve inches square and open up the grass. Open the mouth of the firing chamber a little bit for a short while. This will draw the fire to the required spot. Close the holes again.

Time required to Burn.—A rough guide to the above is one day to each Cape ton of wood in the kiln. To ascertain this, make use of the following formula.

Assuming that mukarati weighing 48 lbs. per cubic foot (air-dried) is used to make a kiln having a basal diameter (d) of twelve feet and a height (h) of four feet, then the volume (v) of the kiln, which is in the form of a paraboloid, is calculated thus:—

$$v = \frac{d^2\pi}{4} \times \frac{h}{2}$$

$$= \frac{12 \times 12 \times 3^1/_7}{4} \times \frac{4}{2}$$

$= 226$ cubic feet (less 5 per cent., as shape is not usually a true paraboloid)

$= 215$ cubic feet.

Weight of wood is 215 x 48	=	10,320 lbs.
	=	5 tons (approx.)
Therefore, time taken to burn	=	5 days.
Allowed to cool down	=	2 days.
Total		7 days.

It may be taken that wood in reduction to charcoal loses about 50 per cent. of its volume and 75 per cent. of its weight, so that the above-mentioned kiln will give about 2,500 lbs. of charcoal.

Opening the Kiln.—When the kiln has cooled down sufficiently it may be opened, care being taken that it does

not blaze up. To prevent this happening it is necessary to have a few buckets of water ready for use, or if none is available, smother the flames with earth and leave for a day or two longer before opening again. Place the charcoal in three or four heaps, as a chance spark may cause a blaze which can more easily be extinguished in a small heap than in a large one.

The best time to open a kiln is at night, when any sparks can be seen at once.

General.—Only sound and not rotten wood should be used. Charcoal, which is reddish-brown in colour, is not completely carbonised.

Dull colour and softness also indicate over-burning and use of rotten wood.

Careful and slow burning yields a better quality and greater quantity of charcoal.

A good charcoal gives a metallic sound when struck, and should not soil the hands.

Photographs.—

(1) Shows flue and firing chamber.

(2) Method of stacking.

(3) Thatched kiln.

(4) Kiln covered with earth.

(5) Firing the kiln.

(6) Opening the kiln.

REPORT OF THE CHIEF ENTOMOLOGIST

FOR THE YEAR ENDED 31st DECEMBER, 1931.

AGRICULTURAL.

No serious outbreaks of insect pests attacking agricultural crops occurred during the year under review. A few small outbreaks of army worm (*Laphygma exempta*, Wlk.) were reported from Bindura, Umtali, Fort Victoria and Rusape in January. An outbreak occurred on irrigated land in June on a farm in the Melsetter district. Another small outbreak occurred in December in the Sinoia district.

1. *Maize.*—The maize stalk borer (*Glottula fusca*, Full.).—Tests of "Derrisol" showed a 91 per cent. kill of the young larvæ in a trap crop of small maize plants. Further tests showed treated rows to be infested to the extent of 16 per cent., with an average of 0.25 larvæ per plant, while untreated plants were 97 per cent. infested, with an average of 5.38 larvæ per plant.

Emergence of moths of the second brood occurred during the latter two weeks of February. Emergence of moths from the over-wintering brood commenced on the 25th November, nine days earlier than last year. The main emergence occurred during the second week in December. The pupal period was 19 days, and the eggs took 10-11 days to hatch.

Other insects prominent on maize during the year included (1) maize root worm (*Apophyllia murina*, Gerst.) in Concession and Mazoe during January; (2) snout beetle (*Systates exaptus*, Mshl.) at Mount Hampden in December, and (3) *Margarodes* (an underground scale on roots) at Rusape and Salisbury during March and October respectively.

2. *Root Gallworm* (*Heterodera radicicola*).—The rotation experiments laid down in the 1929-30 season were continued according to the initial plan. Each dry season the lands receive double ploughing, and special attention is paid to

weed suppression during the growing season. Both the susceptible seed crop and tobacco showed heavy infestation on land previously cropped with maize. Cotton, Sunn hemp and Florida bunch velvet beans were not infested.

Infestations of a white fly (*Fam. Aleyrodidæ*), previously recorded on tobacco in 1927, coincided with the appearance of a virus disease known as leaf curl on tobacco in various parts of the Colony from November. There have been a few severe infestations of cutworm, and stem borer (*Phthorimæa heliopa*, Lw.) has done considerable damage in certain localities.

3. *Citrus.*—A severe attack by thrips (*Scirtothrips aurantii*, Faure) was experienced in September and October, but satisfactory control was obtained by spraying with lime sulphur. Conditions during the rainy season 1930-31 were favourable to the spread of red scale (*Aonidiella aurantii*, Mask.), which increased rapidly when efficient control was not carried out. Damage by the cotton bollworm (*Heliothis obsoleta*, F.) and aphis (*Aphis tavaresi*, Del.G.) was unusually light. False codling moth (*Argyroploce leucotreta*, Meyr.) shows signs of increasing, but is not yet a pest of serious economic importance. A parasite (*Glypta leucotretæ*, Wilk.) of this pest was discovered during the year, and has since been described as a species new to science. This information has been obtained through the courtesy of the Director, B.S.A. Company's Citrus Experimental Station, at Mazoe.

4. *Cotton.*—Owing to the comparatively small areas planted to cotton, records of pests mostly come from the Cotton Breeding Station, Gatooma. One brood of the American bollworm (*Heliothis obsoleta*, F.) was evident during March. Damage by spiny bollworm (*Earias*, sp.) was severe, while only light attacks of jassid (*Empoasca fascialis*, Jacobi) were reported. Heavy attacks of Sudan bollworm (*Diparopsis castanea*, Hamp.) were reported through the season in many parts of the Colony. Cotton stainers (*Dysdercus* spp.) were widespread and numerous, especially on ratooned cotton.

5. *Stored Products.*—Maize.—Unsuccessful laboratory tests were carried out with a view to finding an economic contact spray against maize weevils (*Calandra oryzæ*, L.) infesting granaries and their surroundings.

Tobacco.—No unusually heavy infestations of the tobacco beetle (*Lasioderma serricorne*, F.) were reported. The moth, *Ephestia elutella*, Hubn., mentioned in our annual report for 1929 as attacking Rhodesian tobacco stored in London warehouses, was found in a tobacco warehouse in Salisbury in June, 1930. Since then it has been found in two cigarette factories in Salisbury, but it has not been found in stored products other than tobacco, nor has it been reported outside the capital. Observations on its life history and control have been made. The preventive and control methods recommended in warehouses include scrupulous cleanliness of the premises and early and complete disposal of the crop. The larva is subject to the attacks of a braconid parasite (*Microbracon hebetor*, Say.).

6. *Miscellaneous*.—(1) The maize weevil (*C. oryzæ*, L.) was found attacking apples in two orchards. (2) A weevil, believed to be *Cylas compressus*, Hartm., was reported in Southern Rhodesia for the first time in October. It was found attacking sweet potatoes in Salisbury. (3) The mealy-bug (*Pseudococcus nipæ*, Mask.) was recorded, for the first time in Southern Rhodesia, on palms in Salisbury. (4) The burnished brass moth (*Phytometra orichalcea*, Fabr.) was reported destroying various crops, chiefly sunflower, in several centres. The infestation died out in February, parasites and disease playing a large part in its suppression. 1919 chalcid parasites were reared from one larva. (5) The scale-insect (*Ceronema africana*, Macfie.) was recorded for the first time in Southern Rhodesia on cultivated fig.

7. *Locusts*.—The territory has been entirely free from locusts during the past year.

MEDICAL AND VETERINARY.

Tsetse Fly.—There has been little change in the general tsetse fly position during the year under review. No major extensions of the main (*Glossina morsitans*, West.) fly belt have been recorded, except in two portions of the low-lying Zambesi Valley, one in the Darwin district and the other in the Sebungwe district. Reliable information is difficult to obtain from such isolated areas, and the spread recorded may have taken place in previous years. No natural retrocession of the fly areas has been recorded during the year. During

the dry season a careful inspection was made of that portion of the Darwin district lying between the Ruia River and the escarpment, where severe losses from animal trypanosomiasis have occurred in the past, and which was previously considered to be permanently infested with fly.

The observations indicate that no "fly" are permanently settled on the high veld south of the escarpment in this district, and have established conclusively that "fly" are continually being carried into the area by game and native pedestrians coming up from the heavily-infested areas lying at the foot of the escarpment. A similar inspection, carried out in the Lomagundi south-west area, indicates a slight retrocession of the "fly" towards the Umfuli River. The total area at present occupied by fly is now roughly 22,000 square miles.

No new game fences have been erected during the year, though financial provision was made for extra fencing in the Gatooma area. A third fence, 10 miles west of the present western game fence, was proposed in order to make the game-free buffer zone 20 miles wide, experience in Lomagundi having shown that a 10-mile wide buffer zone is too narrow.

The shooting operations against game, controlled by the Entomological Branch, have been maintained in the Lomagundi (Umboe), Lomagundi S.W. and Gatooma areas. A small saving in expenditure was made by reorganising the native hunters and also by providing arms and ammunition to unpaid native hunters, who operate under supervision.

In order to intensify the operations against game in the Wankie district, a European ranger has been placed in charge of the area, with a staff of 20 paid native hunters. He also exercises general supervision over the unpaid native hunters previously controlled by the Native Commissioner, Wankie, as well as the guards in charge of the three cleansing chambers erected in this area.

The native hunters employed by the Entomological Branch destroyed 6,502 head of game during the year, while the native hunters under the control of the Native Department destroyed 8,565 head, making a total of 15,067 head. This heavy sacrifice of wild life, and the lack of permanency in the results obtained, emphasises the extreme desirability

of providing for a fully staffed and well equipped research station as soon as the requisite financial provision can be made.

Dr. G. H. Hale Carpenter was invited to visit Salisbury on his return in February from investigating the tsetse fly problem in Bechuanaland. Unfortunately, owing to heavy rains, he was unable to inspect any of our tsetse fly areas. His visit was greatly appreciated, and much valuable information about the position in Ngamiland was obtained.

Mr. C. F. M. Swynnerton, Director of Tsetse Fly Research, Tanganyika Territory, visited the Colony in June and spent several days in the Gatooma fly belt, where trapping experiments were being carried out. The whole problem was thoroughly discussed with him, particularly the question of producing natural thicket barriers.

The benefit derived from such visits is invaluable.

A departmental committee of enquiry to consider the whole tsetse fly problem was appointed in July and took evidence from the public. Its findings are still under consideration by the Government.

1. *Operations, Lomagundi (Umboe).*—Operations against game under the control of the Entomological Branch were commenced in 1926 on the completion of the first fenced zone in December, 1925. In 1928 a third parallel fence was constructed 10 miles north of the old fenced area, creating a zone roughly 20 miles wide, in which intensive shooting operations have been maintained. The operations were extended in February, 1930, to include an area west of the Angwa River. Within the southern fenced zone fly is now extremely scarce, and not one has been caught in this area during the year, except at the traffic control station on the Tchetchenini road. Within the northern fenced zone, an area which in the past was heavily infested, the density of fly has been very considerably reduced. Flies are still present in the vicinity of the Duwe River, and within a mile or so of the northern fence, particularly along the Rukute and Winde Rivers. These are considered to be intruders from the north. No search has been made for puparia during the past two years within this northern fenced zone, though breeding probably still occurs.

The average density of fly north of the fenced zone, where the game is undisturbed, is represented by a figure lower than that recorded in 1930, which was in turn lower than the figure in 1929. This progressive decline is difficult to explain. There is very little game in this area, water is scarce during the dry season, and the country is more broken than the area within the fences. Permanent water and good early grazing is found within the fenced zone on the Winde and Rukute Rivers and their small tributaries. These areas, now inside the fenced zone, were in the past well stocked with game, particularly at the end of the dry season, most of the animals possibly being migrants from further north. Now that the permanent water and early grazing have been fenced off, a change may have taken place in the annual migration of game towards the well watered vleis around Chauka Hill, and this in turn may account for the decreased density of fly north of the fenced zone.

The distinct improvement mentioned in previous reports has been maintained, no serious losses of stock from trypanosomiasis having been recorded from this district during the year. A few new cases have, however, occurred on Robbsdale.

2. *Operations, Lomagundi South - West.*—Operations against game, in charge of a European ranger, were commenced in this area in 1930, after construction of a 40-mile -long game fence west of the occupied farms. The ranger has also taken over local supervision of the native hunters previously under the control of the Native Commissioner, Sinoia. Fairly complete density counts of fly have been made during the year, and a slight retrocession of the fly belt towards the Umfuli and Umniati Rivers has been indicated. Very few new cases of trypanosomiasis have been recorded from farms in the Gambuli Valley and, on the whole, a distinct improvement has occurred in this area following the initiation of these operations.

3. *Operations, Gatooma District.*—Intensified and controlled shooting has been in progress in this area since September, 1927. The area of operations was extended in 1930 to include certain farms and Crown lands on the north-east, and later, in 1931, an area south of the Umniati River. The number of game destroyed each month has tended to increase,

probably owing to the larger area covered, part of which lies outside the fenced zone. Inside the fenced zone very little big game remains, but small buck and warthog are still numerous. The creation of a totally game-free buffer zone is perhaps an impracticability.

Two comprehensive series of density counts have been made in this area during the year, one at the end of the wet season and one towards the end of the dry season. These indicate a continued reduction in the density of fly over the whole area.

Fly is, however, still dense at certain localities near and inside the western fence. Continued infiltration of fly from outside the fenced zone is suspected. How far such infiltration occurs inside the fenced zone is not definitely known, but it is suspected that a few flies may range across the full 10-mile buffer zone. The operations in Lomagundi have clearly indicated that a 20-mile wide buffer zone is necessary before satisfactory results are obtained from operations of this nature.

On two farms in the Gatooma area, close to the eastern fence, the use of oxen is still uneconomic owing to heavy and continued losses from trypanosomiasis. On most of the farms where deaths have occurred in recent years the disease still persists, but the general improvement indicated in last year's report has been maintained.

4. *Operations, Wankie District.*—The course of events in this district has been of particular interest. As is well known, the fly by the year 1918 had advanced sufficiently far to affect cattle along the west bank of the Gwaai River. At that time there was a definite but comparatively light infestation on the south-west side of the Shangani, extending from near the Gwaai-Shangani junction for a distance of some 30 miles up the Shañgani. Towards the end of and after the operations against game in this area commenced in 1919, namely, in 1922 and 1923, very little game and no flies could be found south of the Shangani, and the losses of cattle on the Gwaai River ceased. The operations were discontinued after the year 1922, and a system of shooting concessions was substituted, which proved ineffective. Game began to increase again, and this was followed by increase and renewed spread

of fly. On the basis of reports received, a recrudescence of trypanosomiasis in the Gwaai River was prophesied in 1927, and towards the end of that year this prophecy was fulfilled. The area south of the Shangani was traversed by the Chief Entomologist in 1928, and this visit was followed by a detailed survey on the part of an experienced field assistant. The position in 1927 was apparently comparable with that in 1918, judged from unofficial reports and the incidence of trypanosomiasis on the Gwaai River. The official observations in 1928 confirmed the reports of great increase of game, and increase and spread of fly, which was by then present in some numbers throughout the previously mentioned tract south of the Shangani River. Whereas in 1919 vigorous operations were undertaken against game, whilst the area south of the Shangani was only lightly infested, no such operations were undertaken in 1927 or 1928, certain alternative measures being given precedence. The sequel appears to be sufficiently significant. The fly, instead of disappearing, or, at all events, becoming evanescent, between the Shangani and Gwaai Rivers as previously, has increased so greatly in that area that at the time of the density counts (October, 1931) certain localities showed an infestation denser than anything yet encountered by officers of this branch within the Colony. The highest figure actually recorded was four hundred and thirty-nine (439) flies caught with one net in three hours, but other records are nearly as high. In addition, the fly has, of course, spread much further afield and definitely infested a considerable section of the Gwaai River Valley.

A few more farms were taken up during the year by European farmers on the settlement along the Gwaai River. The general fly position along the Gwaai River became worse rather than better during the early part of the year, and in July the operations against game were intensified by the appointment of a European ranger and 20 paid hunting boys. These boys were distributed along the Shangani River and around the junction of the Gwaai and Shangani Rivers. The native hunters under the control of the Native Department are distributed along the Gwaai River. The European settlers with their hunting boys operated freely over the open area and did not entirely confine themselves to hunting within the vicinity of the settlement. Their efforts were sporadic and

uncontrolled, and their effect on the general position ineffectual. Since the appointment of the ranger and the provision of controlled and intensified shooting, there has been a considerable decrease in the number of game in the area, accompanied by a great reduction in the number of fly along the Gwaai River. Fly is present along the Gwaai Valley for a number of miles above the Gwaai bridge as to make farming with oxen an impossibility. Several years may be required to clear the area of fly and to make the settlement farms safe for domestic stock. Until these farms are safe for stock, no development of a permanent nature can be expected.

5. *Operations under control of the Native Department.*—These operations have been continued during the year. No very clear or definite results have been obtained to date, though no reports have been received of fly spreading or increasing in areas where these operations have been in progress. In the Darwin district the number of native hunters has been doubled in order to intensify the campaign, and the operations have been extended to the low veld north of the escarpment to check the fly spreading into the low-lying country east of the Mvouradonna Mountains. In the Sipolilo Native Reserve the improvement mentioned in previous reports has been maintained, although it is still dangerous to introduce stock into the northern portions of the reserve.

No extension of the fly belt has been recorded in the Miami district or the Urungwe Reserve, and no significant improvement in the position can be reported. The same may be said of the position in the Bubi, Wankie and Sebungwe native districts.

6. *Melsetter District.*—In 1929 one specimen of the tsetse fly (*G. pallidipes*, Austen.) was caught on the Rhodesian side of the border close to the farm Chikore, situated within a few miles of the border. There is nothing to indicate that fly has since become established anywhere within the Melsetter district. Considerable losses from trypanosomiasis have, however, occurred on a number of farms in this district during the past year.

7. *Control of Traffic from the Fly Areas.*—There were seven stations for the control of traffic leaving proclaimed

fly areas functioning at the end of the year. One station was closed down. One station was erected, but not in operation before the end of the year.

(a) *Robb's Drift Road, Gatooma.*—Last year 414 flies were caught at this chamber in nine months. This year 687 flies were caught in twelve months. A considerable amount of traffic is handled at this station, the road being much used by hunters and prospectors and by native pedestrians from the Sebungwe district. During the year 205 cars, 332 cyclists and several hundred pedestrians passed through the chamber. Of the total of 687 flies caught, 334 flies (163 males, 151 females and 20 unidentified) were taken off motor cars, and 353 flies (168 males, 151 females and 34 unidentified) from cyclists and pedestrians. The approximate female percentage of the flies caught off motor vehicles was 47, and off cyclists and pedestrians, 48.

(b) *Tchetchenini Road, Lomagundi (Umboe).*—During the twelve months 120 motor vehicles, 1,349 cyclists and several hundred pedestrians passed through the chambers. Ten flies (4 males, 4 females and 2 unidentified) were caught by the guards.

(c) *Mcheringe Road, Lomagundi (Umboe).*—This station was dismantled in June and the road closed to motor traffic, only two flies having been caught in sixteen months.

(d) *Miami-Zambesi Road.*—This station was also in operation during the whole twelve months, during which time 246 motor vehicles, 50 cyclists and several hundred pedestrians passed through the chamber. The guards caught 92 flies off motor vehicles and 83 flies off cyclists and pedestrians, totalling 175 flies for the year. There is very little traffic on this road during the wet season.

(e) *Sinoia-Copper Queen Road.*—A European was stationed on this road for six months during 1930 to collect information regarding the amount of traffic using this road and to examine all traffic for tsetse flies. As a result it was decided not to erect a cleansing chamber on this road.

The reopening by hunters and prospectors of Linscott's old road leading across the Umfuli and Umniati Rivers created a very real danger of flies being carried into farms in the Gambuli Valley, and in July a decision was made to erect a

cleansing chamber on the Copper Queen road near the boundary of Kanyaga Farm.

Native guards were posted in November. Three cars passed through the chamber by the end of the year, but a large number of native pedestrians were examined. Only 8 flies were caught during the year, 3 on cars before the chamber was erected and 5 (1 male and 4 females) on pedestrians and cyclists.

(f) *Bulawayo-Victoria Falls Road.*—Following the detailed inspection of this area made in 1930, it was decided early in the year to erect two cleansing chambers on the Bulawayo-Victoria Falls road, one in the Dett River Valley about 14 miles from Dett Station, the other on Farm 115, approximately 16 miles east of the Gwaai bridge. Guards were posted in July, and the following amount of traffic passed through the chambers:—

(i.) *Dett River Station.*—This station is situated about seven miles from the Gwaai bridge—a fairly dense fly centre. Three hundred motor vehicles, several hundred cyclists and pedestrians and a number of pack animals passed through the chamber. A total of 230 flies (99 males and 131 females) were caught by the guards, 5 of these were caught off pedestrians and 225 off motor vehicles.

(ii.) *Farm 115 Station.*—Fewer flies were caught at this chamber than at the Dett River chamber, Farm 115 being further than the Dett chamber from the fly centre around the Gwaai bridge. Two hundred and eighty-three motor vehicles, several hundred cyclists and pedestrians and a few pack donkeys passed through the chamber. One hundred and twenty-eight (128) tsetse flies (55 males and 73 females) were caught by the guards, 110 off cars and 18 off cyclists and pedestrians.

A third chamber for the cleansing of traffic entering the Bulawayo-Victoria Falls road by Walker's road was erected in November, but the guards were not posted until the end of the year.

8. *Experiments with Tsetse Fly Traps.*—The experiments with the Harris tsetse fly trap, various modifications of this trap, and some other models which were reported upon last year have been continued.

Twenty-two (22) traps were used in the experiments, which were carried out at Nyampani vlei in the Gatooma district. Variations in the size and position of entrance slits, the attractiveness of different colours, orientation and position of the traps in relation to the surroundings were tested. Meteorological records, including temperature, relative humidity, wind velocity, cloudiness, etc., were kept. The results have been disappointing in many respects.

Dark blue and black were found to be the most attractive colours, but the efficiency of the traps also varied greatly with such factors as position, amount of movement in the vicinity, seasonal and daily meteorological conditions and the concentration of fly around local dry season foci.

The largest numbers were caught in August and September; in October the number caught gradually decreased. After the commencement of the rains the catches became almost negligible.

The maximum daily catch was made in August, when one trap caught 164 flies (90 males and 74 females). This trap caught 930 flies (491 males and 439 females) in September (an average of 31 per day), 274 flies in October (an average of 9 per day), and 10 flies in 22 days in November (an average of 0.45 flies per day). The average daily catch of 17 traps in November was 0.4 flies.

There does not appear to be any correlation between the average density of fly over the whole area and the catches made by the traps when left unattended. The average of a number of standard density counts, i.e., male flies caught per net per boy per hour, was 31 in August, 27 in September, 27 in October and 20 in November. A boy could, therefore, in November catch twice as many flies in one hour with a net as the best trap caught in a month. Movement is a much greater attractive force than a stationary object.

As a result of these experiments, which confirm the results obtained in 1930, it is considered that present known methods of trapping will not eliminate *G. morsitans* in Southern Rhodesia. Even in selected areas of fairly high density the numbers caught were quite insignificant compared with the total numbers of fly present in the area.

9. *Reconnaissance and Investigation.*—Detailed reconnaissance surveys were made in two areas to plot the approximate limit of the fly belt.

(i.) *Urungwe-Miami.*—This survey re-determined the limits of fly north of Miami and east of the Miami-Sinoia road. No expansion of the belt was recorded.

(ii.) *Darwin.*—This survey established the fact that tsetse were being carried up the escarpment by pedestrians and game coming up from the heavily infested country at the foot of the escarpment. Fly has not yet become established on the high veld south of the escarpment in this district.

Screw Worm Investigations.—Since its first serious appearance in the Mazoe Valley in the wet season of 1918-19, the screw worm fly (*Chrysomyia bezziana*, Vill.) has become a pest throughout the Colony, causing serious losses in most ranching districts. The habits and life history of the fly were studied by an entomologist in the Balla Balla area from February to May. The incidence and contributory causes of wound myiasis in cattle, horses and sheep were also investigated.

Female flies were frequently observed in nature feeding upon blood and septic liquids exuding from cuts, bruises and other wounds in cattle. Only one male fly was found, viz., among blow flies feeding upon the sweet-scented secretions ("honey-dew") on a paspalum grass infected with ergot. Female flies are strongly attracted to screw worm infested wounds, which always possess a characteristic powerful odour. No screw worm flies were seen at purulent wounds. Oviposition was witnessed mostly in the neighbourhood of kraals, where cases of myiasis were treated, but several flies deposited eggs on wounds of an animal used for experiments in a darkened stable.

The eggs are usually laid at the edge of wounds, and not on the unbroken skin. The female deposits the eggs in several batches of about 150 in each, using a sticky secretion of the accessory glands to fasten the batches securely to the skin. Hatching takes place in 12-18 hours or longer. The larvæ feed on blood and septic exudations around the wound, and usually do not invade the living tissues until after the

second moult, i.e., about 2-3 days after hatching. In about 6-7 days from the time of hatching they are full-fed. They then drop to the ground, where, after an interval of 2-3 days, they pupate about half an inch under the surface. The duration of the pupal stage varies from about a week in the hot weather of February to 27-35 days in the winter months of June and July. No parasites of the larvæ or pupæ were discovered. Small *Pheidole* ants carried off small larvæ which were removed from wounds during treatment in the kraals.

Cows and young stock were chiefly attacked. Over 60 per cent. of the wounds were considered to have originated in heavy infestations of the bont-legged tick (*H. ægyptium*). Faulty branding and dehorning sometimes resulted in severe cases. A few cases occurred in trek oxen and bulls. The accidental breaking of horns, "ingrowing" horns and "poking" were responsible for many cases among steers. Several cases of myiasis in black-head Persian sheep were found to be due to both *C. bezziani* and the blow fly, *Lucilia cuprina*, Wied. One case occurred among horses.

The substances commonly used by ranchers as larvicides, e.g., petrol, carbon bisulphide, disinfectants, etc., are not entirely satisfactory, as approximately 65 per cent. of full-fed larvæ removed and discarded from treated wounds are able to complete their development. It is most important that the screw worms be effectively disposed of, otherwise the neighbourhood of kraals where cases are treated becomes a centre of infestation.

Further experimental work is necessary to discover really effective repellents and healing substances for use in cases of myiasis. "Defensol" has been found to be an effective repellent for at least three days.

Although few deaths are directly due to myiasis, the expense of mustering and handling stock for treatment of wounds is considerable, and constitutes a heavy burden on the cattle industry, and the loss in condition of infested stock is often very great.

Attempts to induce oviposition under laboratory conditions in Salisbury failed. Adult flies lived from 3-4 weeks in captivity.

Muscid Flies Affecting Live Stock.—Further observations were made on the habits and life history of muscid flies of veterinary importance, particularly *Musca crassirostris*, Stein., *M. lusoria*, Wied., *M. vetustissima*, Wk., and *M. interrupta*, Wk.

Professor Patton, of the Liverpool School of Tropical Medicine, has collaborated in the study of the morphology of the immature stages of these flies, and also the screw worm fly, *C. bezziana*.

Tobacco Pests Suppression Act, 1931.—In May an Act was promulgated providing for the registration of all warehouses where tobacco is held and prepared for export, for the inspection and cleansing of such warehouses, and for the destruction, where necessary, of tobacco found to be infested with a declared pest.

Licences were granted to twenty-two (22) warehouses after inspection during the year.

The Act has proved both difficult and expensive to administer, and certain amendments to simplify its administration are proposed.

Inter-State Conference on Plant Importation Regulations.—An inter-State conference was held in Salisbury on the 26th, 27th and 28th August with the object of formulating a common policy which should govern the laws adopted by the various States concerned, to regulate the importation of plants and certain plant products. Delegates from the Union of South Africa, Northern Rhodesia, Nyasaland and the Belgian Congo were present at the conference. Principles upon which protective legislation should be based were agreed upon, and, with minor differences governed by local conditions and requirements, the details of uniform regulations were drawn up.

Regulations, based on the decisions of the conference, will shortly be gazetted.

Nurseries Ordinance, 1909.—During the year fifty-two (52) nurseries were registered under the Act, and fourteen (14) were inspected.

The sale of plants from unregistered nurseries has been considerably restricted and the provisions of the Ordinance more vigorously enforced.

Importation of Plants Regulation Ordinance, 1904.—The following consignments have been dealt with by the plant inspectors at the various ports of entry during the year:—

Salisbury	2,230
Bulawayo	10,275
Plumtree	231
Umtali	454
Gwelo	622
Total	13,812

One hundred and fifty-two (152) special permits for the introduction of plants, etc., into the Colony were issued during the year.

Seventy-one (71) annual permits were granted to registered nurserymen in the Union of South Africa.

Regulations in other Countries Affecting Export of Plants from Southern Rhodesia.—Twenty-nine (29) certificates of cleanliness have been issued in respect of plants intended for export to other countries.

Injurious Substances and Animals Ordinance, 1909.—Six (6) certificates for the importation of bees-wax and two (2) for the importation of foundation comb were granted during the year.

Lectures.—Four (4) lectures on agricultural entomology were delivered to the pupils of the Tobacco Experimental Station, two lectures on ticks to the B.S.A. Police and one popular lecture on mosquitoes to school children in Salisbury.

Farms Visited.—Forty (40) farms were visited and advice given by members of the staff.

Agricultural Shows.—An exhibit of insect pests was placed on the Agricultural Show at Salisbury, with one officer in attendance.

Publications.—"Locusts in Southern Rhodesia," by R. W. Jack, Chief Entomologist, in the *Rhodesia Agricultural Journal* for January (Vol. XXVII., No. 1).

Identification of Insects.—During the year over four hundred specimens of insects were submitted to specialists abroad for study. Eighty (80) species were identified by the Imperial Institute of Entomology and the British Museum

(Natural History). Fifty-two identifications were received from the United States National Museum, the American Museum of Natural History, and other institutions.

Staff.—Mr. R. W. Jack, Chief Entomologist, left on vacation leave on the 14th December.

Mr. A. Cuthbertson, entomologist, left on vacation leave on the 27th July.

Miss W. M. Shepherd recommenced duties as clerk-typiste on the 13th April, *vice* Mrs. Slocock, resigned.

Acknowledgment is made of the loyal and efficient services of the headquarters and field staff during the year.

J. K. CHORLEY,
Acting Chief Entomologist.

GWEBI PRODUCE PRICES.

Hull-less oats	40/- per bag of 150 lbs.
Large Black sunflower seed ...	14/- per bag of 100 lbs.
Dolichos beans	35/- per bag of 200 lbs.
Linseed	60/- per bag of 200 lbs.
Linseed (quantities under 100 lbs.)	4½d. per lb.
Sweet potato tubers (Calabash Leaf)	6/- per bag of 150 lbs.
Napier fodder roots	6/- per bag of 40 lbs.
Sweet potato cuttings (Calabash Leaf)	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.
Pumpkin seed	1/1 per lb.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

THE SOFTENING OF WATERS.

By the Division of Chemistry.

Of the many samples which are submitted to the chemical laboratory by farmers for analysis, a fairly large proportion consists of waters drawn from river, well or bore-hole which are intended for use on the farm as feed water for steam boilers. Many of the samples on examination prove themselves to be quite unsuitable as drawn from the source, and treatment has to be resorted to before the water can be safely applied. It is the purpose of these notes to explain briefly why such waters are unsuitable, and to show the chemical mechanism which converts them into harmless and useful agents for the work which the farmer intends them to perform.

The harmfulness or otherwise of a water depends primarily on whether it contains any substances in solution. Basing the classification upon this fact, all natural waters are divided into two groups—soft waters and hard waters. By soft waters are meant all those waters which contain only minute quantities of soluble solids, and as far as the farmer is concerned, these are the safe waters to use for boiler purposes. Unfortunately, however, the larger proportion of the waters in this country are not soft, but fall under the second heading, and the problem which they present is the removal of the "hardness" and the conversion of the supply to a soft and therefore harmless and useful water.

Hard waters, or waters containing considerable quantities of dissolved solids, are further divided into two classes, with only one of which we shall deal here, as the other is encountered but rarely. These types are "permanently" hard and "temporarily" hard waters, and it is the latter that is of greater importance to the farmers of Rhodesia. This temporarily hard water contains in solution the bicarbonates of calcium and magnesium, and such water presents

considerable difficulties in the formation of a lather with soap. This difficulty is due to the inter-action of the calcium and magnesium salts in the water with the soap to form insoluble salts, which appear as a scum round the sides of the vessel, and until all the calcium and magnesium have been converted into this insoluble scum, no lather will form. It is owing to this fact that the term "hard" has been applied to such water.

In order to understand how such a water may be rendered soft and fit for use, an explanation of how these salts come to be present in the water would be advantageous. One of the constituents of the atmosphere surrounding the earth is the gas carbon dioxide (commonly known as carbonic acid gas), which, though it forms but a small fraction of the air, is exceedingly important in the balance of nature. It is composed of two elements, carbon and oxygen, and is formed when any carbonaceous matter is burned, i.e., oxidised. When this gas comes in contact with water, chemical union takes place, and since water is composed of the two elements hydrogen and oxygen, we now get a new compound containing hydrogen, oxygen and carbon. This compound is carbonic acid, a weak acid which can exist only in dilute solution. Taking the symbols H for hydrogen, C for carbon and O for oxygen, we can write this interaction in the form of an equation, thus:—

$$\underset{\text{Water.}}{H_2O} + \underset{\substack{\text{Carbon dioxide}\\\text{or carbonic acid gas.}}}{CO_2} = \underset{\text{Carbonic acid.}}{H_2CO_3}$$

Now there are in Rhodesia considerable quantities of limestone formations, many of them appearing as outcrops at the surface and many buried beneath other strata. These rocks contain large quantities of carbonate of lime, a substance practically insoluble in pure water. Most waters, however, as we have seen, dissolve varying quantities of carbonic acid gas, chiefly by absorption from the atmosphere, and when the carbonic acid so formed comes in contact with limestone, the carbonate of lime is converted into the soluble bicarbonate by chemical union with the carbonic acid, and this is immediately dissolved and carried off by the water, giving a temporarily hard water. We therefore have—

Carbonate of lime + Carbonic acid = Bicarbonate of lime.
(Insoluble.) (Soluble.)

It is obvious then that, to render this water soft again, means must be found of reversing this reaction and breaking up the bicarbonate into the insoluble carbonate and carbonic acid. There are two chief methods of accomplishing this.

(1) If the temporarily hard water be boiled, the bicarbonate breaks down into insoluble carbonate and carbonic acid, and as the latter decomposes in boiling water, the carbonic acid gas is driven off, thus removing the chances of the newly formed carbonate being again converted into soluble bicarbonate. The carbonate is thrown down on the walls of the vessel as a very fine powder, which gradually accumulates as a scale or "fur," while the water, having now lost its dissolved solids, is soft. The danger in using temporarily hard water in boilers is thus explained, for as such water is boiled there gradually forms on the inside of the plates a thick coating of carbonate of lime. This coating will cause a very considerable loss in the efficiency of the boiler. Further, if this scale cracks when heated—as it frequently does, owing to its having a different rate of expansion from the metal plates—cold water entering the boiler will get through these cracks to the highly heated plates beneath, and the sudden generation of steam so produced may be sufficient to burst the boiler, or at least crack the plates. A further point to be noted in this connection is that when water containing bicarbonate of lime is heated slowly—as, for example, in the initial heating of the boiler—the lime carbonate deposits as the well-known mineral calcite, which forms an exceedingly hard scale and one which presents great difficulty in subsequent removal. Feed pipes may become choked, necessitating the opening of the boiler long before its usual time, and the inlets to water gauge taps may become filled up, thus leading to entirely erroneous gauge readings. If only for these reasons, it is highly inadvisable to use temporarily hard water in any boiler without first resorting to other means of softening it.

(2) Whilst the method of boiling the hard water as a means of softening is quite suitable when one requires only small quantities, it is impossible of application on the large scale required by the farmer. Another method has therefore to be sought—a method which will conform to the specifications of cheapness and ease of application. Such a one has

been found in the method of "liming." When lime interacts with calcium bicarbonate, insoluble calcium carbonate is formed, and consequently when lime (quick or slaked) is added to temporarily hard water, the calcium carbonate will be precipitated, leaving the water soft. Putting this in the form of an equation, we have—

Calcium bicarbonate (Soluble.)	+	Calcium hydroxide (Soluble.)	=	Calcium carbonate (Insoluble.)	+	Water (soft).

The interaction of the two substances on the left-hand side takes place according to definite proportions, for writing this equation in chemical symbols and deducing the interacting quantities therefrom we find that 162 parts by weight of the bicarbonate interact with 74 parts slaked lime or 56 parts quicklime. Hence, by estimating the quantity of bicarbonate in a sample of temporarily hard water, it is possible to calculate exactly how much lime must be added to leave the water soft, i.e., having no surplus bicarbonate of lime left in solution.

In practice it has been found that the most efficient arrangement for applying the liming method is to run the hard water into broad and shallow tanks of known capacity. The correct quantity of lime is then added, well stirred in with large poles, and the sludge (chiefly insoluble calcium carbonate) allowed to settle for some twenty-four hours. The clear soft water on the top is then run off and employed as desired, the tank refilled with hard water, fresh lime added, and sludge and lime stirred up as before. A series of tanks can be arranged so that a constant supply of soft water may be obtained. The advantage to be obtained from the use of such soft water will more than compensate for the expense involved in the procuring of lime, preparation of tanks, etc. Moreover, the maintenance costs of running steam boilers will be very greatly reduced, as time and money will not have to be expended on frequent dismantling and scraping of the boiler plates.

INVESTIGATION OF THE BACON INDUSTRY IN SOUTHERN RHODESIA.

Object of the Investigation.—The committee set itself to secure evidence on the following points:—

(1) The quality of the bacon produced locally compared with that imported from the Union of South Africa.

(2) The reasons for any difference in quality should it be found to exist.

(3) Whether the difference between the price of pigs on the hoof and the retail price of bacon was reasonable.

(4) The effect of the importation of bacon from the Union on the local market.

(5) The possibilities for development of an export trade in pig products.

From the 1st to the 9th February (inclusive) the committee visited the bacon factories in Salisbury and Bulawayo which account for 90 per cent. of the factory production in the Colony, and met most of the important retailers and wholesalers in these two centres.

The committee did not inspect the books of the different firms visited, and the conclusions set forth in this report are based on statements made to the committee by responsible persons in the firms named.

The statistical data were supplied by the Government Statistician.

Results of the Investigation.—

(1) *The quality of the bacon produced locally as compared with that imported from the Union of South Africa and overseas*:—

(a) *Union Bacon.*—The evidence given to the committee indicated that, on the whole, the bacon imported from the Union was superior to that produced locally.

The opinion of the retailers in Bulawayo was unanimous on this point, and specimen sides seen by the committee confirmed their judgment.

In this respect the attitude of the retailers in Salisbury differed greatly from that taken by the Bulawayo firms. At the time of this investigation, as far as could be determined, no Union bacon was being sold in Salisbury, whereas approximately 60 per cent. of the bacon sold by retailers in Bulawayo was of Union origin. Since bacon from both the large local factories is on sale in Bulawayo, the committee must attribute this difference in the source of the bacon consumed at the two centres to the greater strength of the "Buy Rhodesian" sentiment in Salisbury and to the personality of the men associated with the Neill's Bacon Factory in Salisbury.

The retailers in Bulawayo stated that while some Rhodesian bacon was equal to any of the bacon imported, on the whole it was not as uniform in regard to cure, finish, firmness or weight as the imported article.

In Salisbury retailers were divided on this point. They did, however, state that one side in two or three was not up to trade requirements.

When questioned as to the attitude of the public towards this "unsatisfactory bacon," the general reply was that the public seemed satisfied, though some bacon was occasionally returned. This acceptance by the public of a poor quality product does not encourage the factories to turn out a better article.

(b) *Overseas Bacon.*—The quantity of bacon imported from overseas is insignificant. In 1931 it amounted to 1 per cent. of the amount consumed locally. Because of its keeping quality, it is generally used for the "bush trade," but has no appreciable influence on the general situation.

(2) *Reasons for any difference in quality should it be found to exist.*—The committee is of opinion that the chief reason for the inferiority of part of the local bacon is the unsatisfactory quality of the bulk of the pigs produced in the Colony.

Both the feeding and the breeding of the pigs are at fault. In this connection it is only fair to state that most producers consider the prices paid for pigs of bacon weight

—2½d. to 3½d. per lb. live weight—during 1931 did not justify proper feeding or management. The majority of the producers stated to the committee that at present feed prices the cost of production of pigs was not less than 3¾d. per lb. live weight. Some producers were able to bring carefully compiled figures to substantiate this view. Under present conditions this committee feels that these estimates of costs are not high, but at the same time it would point out that by improved methods of management it should be possible to reduce appreciably these production costs. Since this investigation was completed there has been a rise in the price of pigs without a corresponding advance in the price of feeds, which makes better feeding a more attractive proposition to the ordinary farmer.

Another reason is the lack of grading. A certain amount of grading is carried out at the two factories visited. These factories estimate that about 50 to 75 per cent. of the pigs marketed are suitable for their requirements. While this may be true under existing conditions, the committee is of the opinion that this estimate is much too high when judged by the standards of quality usual in bacon-exporting countries.

It may be pointed out that the factories in the south have an advantage over our local factories in their ability to dispose of inferior grades of bacon economically. They have large supplies of pigs to draw upon, which enables them to grade with greater discrimination than the local factories, and to build up definite grades or brands of bacon, disposing of the inferior qualities at a lower price on the less particular markets.

In this connection it should be emphasised, however, that the disposal of inferior grades of bacon is not always an advantage, as it may tend to reduce the general level of prices, and may, if carried to excess, prevent competing factories from paying a proper premium for first-grade pigs.

Another factor is the alleged unreliable bacon "curing" of the local bacon factories.

Unfortunately the committee has not the necessary experience to make an authoritative statement on this point. It did appear, however, that the facilities at both factories were

good enough to meet the moderately critical taste of local consumers, and that the variations in "cure" pointed out to the committee were more due to carelessness at the factory than to lack of ability to produce satisfactory bacon.

3. *Whether the differences between the price of pigs on the hoof and the retail and wholesale price of bacon were reasonable.*—The data on this point have been separated into:—

(a) spread between wholesale and retail prices of bacon; and

(b) spread between price of pigs on the hoof and the wholesale price of bacon.

(a) *Spread between the wholesale and retail price of bacon.*—It was not possible to get detailed figures relating to the cost of retailing. Most firms appear to treat the sale of bacon, hams and smalls as an integral part of the general grocery business and do not keep separate costs.

The factories are greatly handicapped by the difficulty in disposing of shoulders and hams. This difficulty does not directly affect the retailers who in general handle three-quarter sides as a main line ordering shoulders and smalls separately. Some firms carry the distinction even further and only handle "middles."

Working on the basis of a three-quarter side, which includes the ham, the figures quoted to the committee for retailing, including wastage, delivery and overhead expenses, varied from 2d. per lb. to 5.8d. per lb. of bacon and ham sold. The lower costs, strangely enough, were given by the smaller firms. In each instance the retailer considered his distribution charges to be reasonable.

An important variation lay in the estimate of wastage in cutting up the sides. The figure given for wastage varied from 5 to 20 per cent. of the weight of the side. The soft nature of much of the bacon used locally makes a certain amount of wastage inevitable, a portion of the flank and shoulder bacon having to be cut away and sold at a lower price or discarded. A wastage of over 10 per cent., however, seems excessive to the committee. In this connection the committee understands that a wastage of 3½ per cent. for turn

of scale and evaporation is considered reasonable in the United Kingdom.

Allowing for a very liberal margin in regard to these figures, the committee feels that, on the evidence submitted, the distributing cost should not exceed $4\frac{3}{4}$d. per lb.

Where the wholesale and retail prices are 11d. and 1s. 6d. per lb. respectively, a fair summary of the retailer's costs of distribution as given to the committee would be :—

Wastage 10 per cent. on 11d.	1.1d.
Overhead charges 15 per cent. on 1s. 6d.	2.7d.
Cash discount 5 per cent. on 1s. 6d. ...	0.9d.
	4.7d.

Excluding contract sales, the average wholesale and retail prices for three-quarter sides quoted to the committee at the time of the investigation are shown in the following table :—

	Bulawayo.	Salisbury.
Average retail price per lb. ($\frac{3}{4}$ side)	1s. 8d.	1s 6d.
Average wholesale price per lb. ($\frac{3}{4}$ side)	11d. to 12d.*	11d.
Average difference per lb.	8.5d.	7d.
Average estimated distributing charges	4.75d.	4.75d.
Profit per lb.	3.75d.	2.75d.

These differences the committee consider too high, and would point out in general support of this view that :—

I. The retailers draw their supplies of bacon almost daily. The turnover is very rapid. Articles dealt with in such circumstances are usually "cut lines," and merchants are required to take a low rate of profit on them. A profit of 1d. per lb. per day on bacon purchased at 11d. per lb. is equivalent to 9 per cent. per day, or over 3,000 per cent. per year, which is exorbitant.

* Excluding a small amount imported from the Union at 1s. $3\frac{1}{2}$d. per lb. and bacon from the United Kingdom.

II. The margin prevalent in Johannesburg in retailers of similar standing is 5d. per lb., as compared with this 7-8.5d. in Salisbury and Bulawayo. Certain retailers in Salisbury cut up and dispose of three-quarter sides at 1s 2d. per lb., which allows a margin of 3d. This is a convenient transaction and presumably not carried out at a loss, but the convenience is hardly sufficient, in the opinion of the committee, to justify a difference of 4d. a lb. in the selling price of whole sides and retail bacon.

High costs are not in the interests of the local industry, and it is suggested that some good might result from the publication of the facts just stated.

When questioned as to the possibility of the increased consumption of bacon if the retail price were lowered, most retailers expressed the opinion that not much difference in consumption would result.

For a semi-tropical country, the *per capita* consumption of bacon in Rhodesia is not low, and the comparative figures given below should be of interest:—

United Kingdom	28 lbs. per annum
Canada	25 lbs. per annum
New Zealand	15 lbs. per annum
Australia	12 lbs. per annum
Southern Rhodesia	12 lbs. per annum
Union of South Africa	5 lbs. per annum

From the figures given by the Government Statistician, the local consumption of bacon has apparently slightly decreased during the last four years, the *per capita* consumption and the price of bacon for the last four years being:—

	Per Capita consumption, lbs.	Average retail price (certain cuts). Salisbury.	Bulawayo.
1928	15	2/3d.	2/4½d.
1929	14	2/5d.	2/4½d.
1930	12	2/4d.	2/4d.
1931	11	1/9d.	1/11d.

(b) *The spread between the price on the hoof and the wholesale price of bacon.*—From the figures submitted to the committee, it appears that the manufacturing costs of bacon are appreciably higher in this Colony than at the larger factories in the Union or in the United Kingdom.

The comparatively high manufacturing costs in the Colony are, to a certain extent, explained by:—

1. Small turnover.
2. Wasty and unsuitable pigs.
3. Wastage of by-products.
4. Heavy trimming necessitated by fatty sides.
5. Spoilage in cure during the hot weather.
6. Bruised pigs in transit to the factory.
7. Lack of demand for shoulders and hams.

All these disadvantages are to be anticipated in a new country, but, despite this allowance, the committee was struck by the extremely low return of saleable product shown by the two factories, and consider that by stricter grading at the factory and more care in the "cure," it should be possible to raise the percentage of saleable product per pig very considerably.

Data from the two factories were obtained in regard to return of saleable product per pig. These are shown below:—

Bulawayo and Salisbury, 1931—

Average live weight of pigs	176 lbs.
Average weight recovered as—	
Bacon and hams	69.5 lbs.
Sausages	15.4 lbs.
Lard	10.4 lbs.
Total	95.3 lbs.
Average percentage of weight of pig recovered as saleable product ...	54.1%

These returns are low, and representative figures from the United Kingdom are given below for comparative purposes:—

Loss of Weight in Slaughter—

Live weight	180 lbs.
Less primary offal (liver, lungs, heart, entrails, average loss $23\frac{1}{2}\%$)	42.3 lbs.
Dressed carcase	137.7 lbs.
Less secondary offal (dressed carcase, head and tail, feet, backbone, tenderloin, pelvis bone, shoulder blade, kidneys, kidney fat, average loss 20%)	27.5 lbs.
Weight available for curing	110.2 lbs.
	= 61.2%
Smoked bacon	104 lbs.
	= 57.7%

(*Adapted from Economic Report No.* 17, *Ministry of Agriculture and Fisheries.*)

Assuming a 10 per cent. shrinkage, which the committee understands is considered a normal allowance for losses in curing and smoking in Rhodesia, the weight of bacon alone for a 180-lb. pig should be not less than 100 lbs. This figure exceeds the total product in the case of both factories.

The comparison is not perhaps altogether a fair one, as the figures quoted for the United Kingdom are for purely bacon types of pigs, but it illustrates the low return in bacon secured by the local factories and the possibility of improvement.

The loss of by-products is a serious one. In Denmark, it is estimated that the by-products represent 10 per cent. of the value of the pig. In the local factories the small turnover does not permit of an economic use of the by-products, and a serious loss results.

4. *The effect of the importation of bacon from the Union on the local market.*—Strong representations were made to the committee with reference to the "dumping" of bacon from the Union of South Africa.

In this connection the committee would point out that:—

(i.) The price of bacon in Bulawayo is actually higher than in Salisbury, which does not indicate "dumping."

(ii.) The Union bacon imported is, in the opinion of the Bulawayo distributors, on the whole, superior to the local article, and thus an influence towards the betterment of the local article.

(iii.) The Colony does not at present produce sufficient bacon for its own consumption.

At the time of the investigation the chief brand of imported Union bacon was selling wholesale in Bulawayo at 1s. per lb. for three-quarter sides. Statements made to the committee to the effect that Union bacon was on offer at 9½d. per lb. were definitely denied by the wholesale agent of the factory. He explained to the committee, however, that a low grade of belly bacon made by his firm was being sold by the piece at a lower price.

The price of 1s. per lb. is not considered an unreasonable one. From information received, it appears that similar bacon was selling in Johannesburg at 1s. per lb. at the time of this investigation. As the railage charge of 1d. per lb. has been borne by the exporter, and as the difference in exchange is met presumably by the exporter and the export subsidy in operation in the Union, the sale price of 1s. per lb. in Bulawayo does not appear to indicate serious dumping.

5. *The possibility for the development of an export trade in pig products.*—The local demand for bacon could be supplied by some 10,000 pigs per annum, which is only 2,000 to 3,000 more than the present supplies to the factories. It is clear, therefore, that no considerable development of the industry is possible while producers are entirely dependent on our local market. The development of an export trade is essential if the industry is to become of national importance. The export markets open to us are: Northern Rhodesia, the Congo, Mozambique Territory, Nyasaland, the Union of South Africa and the European market.

The Northern Rhodesia and the Congo markets are at present held by the Union factories almost entirely. The Mozambique requirements are supplied largely from Europe, and Beira merchants are of the opinion that Rhodesia would find it very difficult to compete in the best of circumstances.

The Union as a market for our supplies would depend on our being able to produce more cheaply than the Union factories. It is more than probable, however, that economic circumstances favourable to cheaper production in Rhodesia would apply with equal force in the Union, whose producers have hitherto been able to hold their own local market, and should be able to continue to do so.

Nyasaland is a small market.

At the present time, the export of pig products from the Colony is, moreover, handicapped by veterinary restrictions imposed by adjoining territories.

The greatest hardship imposed by these restrictions has been in connection with the export of live pigs to the North and South, which in 1930 amounted to 4,991 pigs, valued at £13,067, and of bacon and hams and fresh pork to Portuguese East Africa, which in 1930 amounted to 36,640 lbs., valued at £1,929.

It should be mentioned also that the manager of Neill's Factory considers that the Union would offer a valuable outlet for rolled shoulders, which are very difficult to dispose of in our local market.

Pig farmers in this Colony have therefore to look to the United Kingdom as the only secure outlet for their produce. In 1930 the United Kingdom imported over £40,000,000 worth of pig products. The inferior quality of our products and their comparatively high cost of production at present prevent this Colony from taking advantage of the English market.

The country is, however, well suited to the production of pigs on an economic basis. Satisfactory pigs, either for the bacon or the frozen pork trade, could be produced locally if the proper methods were followed, and the committee is satisfied that the industry in this Colony could be developed on lines similar to New Zealand and Australia, which of recent years have developed an important trade in frozen pork. The pig industry is, moreover, an essential sideline to the dairy industry, and an important consumer of maize.

The transition from a local to an export trade will not be easy.

The export parity of frozen pork—the most payable produce at present—is 3d. per lb. This figure is below the value of 3¾d. which local producers consider to represent the minimum cost of production, and until the average cost of raising pigs in the Colony is substantially reduced, no export is possible on economic lines.

In a general way it may be said that producers in this Colony are favourably situated in regard to the cost of the basic elements in production—feed, labour, capital. By scientific feeding and management, the two factors lacking at present, the committee believes that the cost of the bulk of the product could be brought down to-day to at least the 3½d. level. When this level is reached, export should become possible with the assistance of a comparatively small bounty, the need for which should disappear as the trade becomes organised and conditions overseas return to normal.

In the early stages the chief problem will be to obtain sufficient pigs to ensure the continuity of supply necessary to develop an export trade. The question of a bounty to finance export has been given much attention in the Union of South Africa. The opinion in the south appears to be crystallising on the necessity of a levy, comparable with the present levy on dairy products, to bridge the large immediate gap between local and export prices.

As the committee is of the opinion that some such system of bounty will be necessary to enable an export trade in pig products to be developed from this Colony, it would, therefore, urge that an early effort should be made to organise a Pig Producers' Association on lines similar to the one recently organised in the Union to bring pig farmers together and to create the sentiment necessary to bring a grading system into successful operation, and to make the imposition of a levy possible as soon as the necessity arises.

Three factories—the Rhodesia Export and Supply Company, the Farmers' Co-op., Salisbury, and Neill's Factory—were inspected to obtain a general idea of their suitability for the efficient handling of pigs for export. One of these, the Farmers' Co-op. Factory, Salisbury, is not working at present.

A reduction in the cost of manufacturing on the lines suggested in a previous section will be necessary at all these

factories to enable part of the burden of export to be taken from the shoulders of the producer, and as 20,000 pigs per annum is commonly considered to be the minimum output on which manufacturing costs can be reduced to competitive levels, a reduction in the present number of four factories in operation would be an advantage in the early stages of the industry.

The logical steps in the development of the industry are:—

(a) Improve the quality of the local pig and standardise the type as far as possible.

(b) Improve the method of feeding, particularly restricting the use of oil-bearing feeds.

To this end the committee would suggest that a copy of the Departmental pamphlets on pig breeding and feeding should be sent to every pig producer in the Colony, and that efforts should be made for an Animal Husbandry Officer to visit all pig producers as far as finances permit. There can be no doubt that the majority of producers do not give the attention to their pigs which is necessary to turn out the type of pig required overseas.

The committee, however, is convinced that no great improvement can be expected until greater encouragement than at present is given by the factories to the producer and feeder of the better type of pig. It feels that a strict system of grading is necessary to this end, with a significant difference in price for the better grades to encourage a producer to breed and feed on improved lines.

Producers are unanimous in regard to the necessity for an efficient grading system. The factories, while agreeing to the principle, appeared to be suspicious of Government interference, which the producers, on the other hand, considered essential.

The matter of grading seems to be the key to the position, and this committee would suggest that a meeting of curers and representatives of the producers should be held at an early date to discuss the possibility of developing a grading system in which both sides have confidence. If no agreement is possible, the committee feels that it may be

necessary to legislate for a grading system, to be supervised on the same lines as the present grading of cream.

The committee is not prepared to recommend an indiscriminate expansion of the industry at the present moment, but has no doubt that, if growth takes place along the proper lines, the future can be looked to with confidence.

SUMMARY.

(1) The local bacon is, on an average, not so good as the bacon imported from the Union of South Africa.

(2) The chief reason for this inferiority lies in the poor quality of the pigs.

(3) The distributors are making larger profits than are ordinarily considered reasonable in commercial circles.

(4) There is no serious "dumping" of Union bacon at present.

(5) Though conditions are suitable for pig-raising, this Colony is not yet in a position to develop an export trade in pig products to the United Kingdom.

An improvement in the quality of the pigs and a reduction in farm and factory costs of production are essential before an export trade could develop on economic lines.

(6) The lines of improvement suggested are:—

(a) Increased extension work.

(b) The introduction of a grading system.

(c) The organisation of a Pig Breeders' Association.

(d) The imposition of a levy to finance export.

A. E. ROMYN.
C. A. MURRAY.
E. R. JACKLIN.

FARMING CALENDAR.

July.

BEE-KEEPING.

The warmer bees are kept during this month so much the stronger will they come out in the spring. Provide a thickness of 3 inches of cloth coverings over the frames, and where quilts are, on examination, found to be damp, replace them with dry ones. This is a favourable season to carry out repairs to hives. All section and shallow frame combs must be carefully stored away from ants and mice, as these will be wanted for the excellent honey to be stored in them next October, collected from the bush bloom.

CITRUS FRUITS.

The harvesting of mid-season oranges should be completed early in the month; late varieties should be fit to export by the middle of the month. The dead wood should be broken and cut out of all harvested trees; this will minimise mechanical injury occurring with next season's fruit. Trees that are to be fumigated should have the lower lateral branches that touch the soil removed. Trim the trees until all foliage is just clear of the ground. The irrigation of late varieties must be continued and the cultivators kept going. Mark all trees when in fruit if the quality is bad; these may be cut back in August for top working to a good quality fruit. The soil of the early and mid-season varieties may be allowed to become fairly dry, for irrigation of the harvested trees may start an out-of-season growth which will enable pests to flourish and increase for the main spring blossoming flush.

CROPS.

Support agricultural shows, and add to your list of exhibits. Advertise your goods through the shows. Interested people will see them. If you require to make purchases of seed for next season, judge by the exhibits on the show what grower can best supply your needs, and place your orders accordingly. Attend the shows and go there to learn all you can about your business, not merely to have a good time. Seed maize previously selected in the field should be butted and tipped and hand shelled. Keep the butt and tip grain for check-row planting by hand. Do not over-irrigate winter crops, and do not irrigate when the wind is from the south, as this often means frost at this time of year. Troublesome weeds, such as darnel grass or drabok, may be removed from cereal crops by hand. Ploughing should be pressed on with, and maize stalks and roots of maize and other trash from the crop should be collected and burned very thoroughly. A land littered with unburnt and unrotted stalks and roots cannot be brought to a suitable tilth for planting and subsequent cultivation. Silage and sweet potatoes and other succulent feeds will have come into general use now, the potatoes being lifted from the land as required. The application of phosphatic fertilisers which are to be ploughed or harrowed in can be begun. Take the opportunity, during this and the next month or two, of inspecting all boundary and paddock fencing and gates, and effect repairs where required. Give a coat of paint to implements, wagons and carts. This protects the woodwork from rotting and the iron from rust.

DAIRYING.

This is one of the coldest months of the year, and milk production as a rule is low. Those cows which are being milked should receive a full winter ration of succulents (ensilage, pumpkins or majordas), hay and concentrates. Milking cows should either be under shelter at night or kraals should be sheltered against cold winds. The old adage, "Shelter is as good as a meal," should be remembered throughout the winter months.

No difficulty should be experienced in producing first-grade cream at this time. In cold, windy weather due precautions should be taken to ensure that the milk when separated is not below 90 degrees.

Most cheese-makers cease their cheese-making operations at the end of the month, as the milk generally not only is scarce, but begins to be deficient in butter fat. Cheese in the store-room should be carefully watched, as cheese mite is likely to appear on old mature cheese. In order to prevent the undue drying out of the cheese, the floor of the cheese room should be sprayed with water from a watering can.

Butter-making is sometimes difficult because of the low temperature of the cream. The temperature should be raised by immersing the can in warm (not hot) water until churning temperature is attained.

DECIDUOUS FRUITS.

Pruning must be continued, and if possible completed this month. The planting of all varieties is best if done now. Add a liberal amount of water at planting time, then cultivate the basins. Sufficient moisture will be thus retained to keep the newly planted trees going until they start active growth. Repeat waterings when necessary. If trees arrive from the nurseryman in a dry and withered condition, immerse them in water for twelve or more hours until they regain turgidity; then plant. Running water is best. Keep cultivators going. It will be advisable to irrigate all trees towards the end of the month.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during July. Young louse-infested cabbage should be sprayed regularly with a forceful stream of water to dislodge the insects; or if this fails, spray with tobacco extract and soap. The Bagrada bug is difficult to control. Strong tobacco wash and soap, resin wash or an oil spray may be effective, especially against the younger stages. Daily hand picking is useful. Keep plants growing vigorously.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

Maize Beetle.—Infested lands to be thoroughly ploughed throughout the winter.

FLOWER GARDEN.

Seeds of most annuals, perennials, shrubs and ornamental trees may be sown. The pruning of roses should be attended to early. Dahlias and other summer-flowering bulbs should be taken up, divided and replanted. Sweet peas require attention and staking.

VEGETABLE GARDEN.

Sow turnips, peas, cabbage, beet, carrots, parsnips, radishes, lettuce and spinach.

FORESTRY.

Care should be taken to protect all plantations from fire by hoeing or ploughing belts round them and burning any grass likely to be dangerous. Cuttings of various deciduous trees may be taken and struck in nurseries.

Continue pricking out conifers into tins or beds. In preparation for early planting in case the season is favourable, limited sowings of tree seeds may be carried out. If labour is available, preparation of land for planting to be taken in hand.

GENERAL.

Veld fires must be watched for and arrangements made to combat them. The loss that may result and the penalties under the Herbage Preservation Ordinance are to be borne in mind. Fire guards should this month be burnt round all grazing which it is desired to preserve for use later on.

POULTRY.

With the cold weather that we generally have in July, the birds should have extra food, i.e., barley or maize, if the supply of eggs is to be continued. A mixture of stewed linseed and bran should be given to the birds, warm, the last thing before they go to roost. This gives them a little extra food during the long and cold hours of the night at this time of the year and maintains the body heat. A certain amount of shelter is also necessary to protect them from the cold winds. Grass wind breaks about 3 feet high on the windward side of the run are sufficient. Remember that no chickens should be hatched after August; those hatched later take much longer to develop than those hatched before August, and they are usually stunted, weakly and unprofitable. Each month the young stock should be gone through and graded; anything that does not promise to be good should be got rid of. As the hatching season draws to a close, the breeding stock, if not carefully watched and treated, will become run down, and infertile eggs and weak chicks will be the result. Watch the breeding stock carefully and handle them occasionally; if they feel thin and light or the flesh is not hard but flabby, give extra food and more scratching exercise. The male especially should be well looked after and given a meal on three or four days of each week by himself; in addition, he should have some raw meat as often as possible. Good hatching and strong, healthy chicks are wanted right up to the end.

Turkeys should now be in full lay. Never disturb the hens when they are sitting. They are very sensitive and nervous, and unless left mainly to themselves, are apt to desert the eggs or break them. It is recommended that turkey chicks be reared by hand; the hens are poor mothers, they are clumsy, drag their chicks all over the place, and do not feed them as well as an ordinary hen does. The main thing is to keep the young turkeys warm, give them plenty of fresh air, thick separated milk and chopped onions or onion tops.

STOCK.

Cattle.—The bulls may again be put into the herd at the end of the month. Watch for any unthrifty cattle and get them into the home paddock and feed them before they become really poor. The value of a good provision for winter feed will be apparent now. Except under purely ranching conditions winter feeding should be general. Where areas have been properly reserved for winter grazing these should be in use now. The treatment of the dairy herd should be continued on the same lines as in June.

Sheep.—Vleis should now be fairly dry and may be utilised. There is, however, always the danger of internal parasites, and, where feed or grazing can be provided elsewhere, it is better to avoid vleis.

VETERINARY.

Horse-sickness and blue tongue should now have disappeared. Redwater and gallsickness occur all the year round, but the worst time is during the summer, when ticks are prevalent. Sheep may be inoculated against blue tongue now. Scab in sheep will probably be in evidence this month.

WEATHER.

Though rains have fallen during every month of the year in Rhodesia, none is looked for or desired this month. Most stations record an average of .01 to .3 inch over a number of years. Severe cold is likely to occur at this time of year, the lowest temperatures occurring an hour or two before sunrise. Frosts may be looked for, especially on calm clear nights. Cold windy days and damp "guti" weather tell severely on cattle, if shelter and food are not provided.

August.

BEE-KEEPING.

This month is one of inaction as far as the apiarist is concerned and the hive inmates are best left alone, except that once a week a corner of the quilt on the top crate may be lifted to see if the wax moth has gained a footing, as it may do in a colony weakened by death from sundry causes, and in which case all such frames should at once be removed. Towards the end of the month, with warmer weather, the bees will be tempted out for play spells, cleansing flights, etc., and, according to the season, entrance stops may be opened out slightly with advantage.

In the workshop see that a spare hive or two are in readiness, well painted and ready for use at any hour; also have in readiness any requisite spares, and see that all appliances, such as veil, smoker, fuel, etc., are handy, for swarms may now go and come at a few minutes' notice. Where the bees have been left to their winter quarters with a fair supply of food, good results can confidently be looked forward to for the coming honey flow of the early winter weeks.

CITRUS FRUITS.

The first or spring growth should commence about the middle of the month, and the trees should have a good soaking of water when the new growth commences. If Washington Navel oranges are to set their main crop, frequent irrigations must take place from the time of blossoming up to the rainy season. These irrigations create the necessary humid conditions which are so essential to secure a satisfactory setting of this orange. It is advisable to stimulate the growth of unthrifty trees with an application of one to one and a half pounds of nitrate of soda when the first irrigation is given, this application of fertiliser to be followed by good cultivation. The amount of fertiliser recommended is for mature trees. The packing of late varieties will continue throughout the month. No bearing trees should suffer for want of moisture. Irrigation should not take place immediately before the harvesting of export fruit—at least ten days should elapse between irrigation and the harvesting. This is the best month to cut down citrus trees for re-working to better varieties. As the citrus trees are harvested, all dead, diseased and broken branches and shoots should be carefully cut out before the trees come into new growth.

CROPS.

If not already marketed, the main potato crop will probably be sold about now. Do not forget to grade the potatoes properly according to size. The buyer wants potatoes—table or seed—of even size, not large and small indiscriminately mixed. Select and clean farm-grown seeds ready for next season's planting. Label the bags with name and weight of contents.

Build a proper shed for your seed potatoes on the lines recommended in the *Rhodesia Agricultural Journal.* Sort over seed potatoes in store and remove any diseased or rotten. Green oat or barley fodder on wet vleis, or under irrigation, will become ready for cutting. Press on with ploughing and cross-ploughing. Decide what crops are to be grown next season, and, if you think fit, discuss the matter with officers of the Department of Agriculture. If you have not already effected all your purchases, consider the question of what seed you will require to buy for next season, and discuss the matter with other farmers. If in doubt, consult the Department of Agriculture. In frost-free situations, potatoes can be planted for an early crop under irrigation or on damp land. Cart and spread your farmyard manure and plough it under as soon as spread to avoid loss. If you have any long stable manure, apply it to your heaviest land. The application of phosphatic fertilisers to the land can continue. If you do not already have one, put up an implement shed, even if it be only poles and grass. Keep wagons and Scotch carts under a similar shed or in the shade of trees. Speed up the making and burning of bricks if this is still in progress.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. As a rule the weather is sufficiently cold to prevent cream, produced under average conditions, from undergoing rapid deterioration, and it is not usually necessary, therefore, to separate a cream of such high butter fat content as is required during the warmer months of the year. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. Cream can quite easily be cooled to churning temperature if placed outside the dairy and exposed to the atmosphere overnight. During cold weather, however, it is more frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

This is usually a critical time of the year for young dairy stock. For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

DECIDUOUS FRUITS.

All plantings of deciduous trees should be completed by now, as the late planting of these trees is generally unsatisfactory. Pruning may be continued up to the middle of the month. It is advisable to water or irrigate all deciduous trees before blossoming; if possible, a second irrigation should be given after the trees have set their fruit. Follow up the irrigations with good cultivation.

ENTOMOLOGICAL.

Potato.—Early planted crops of potatoes may be attacked by caterpillars. The crops should be sprayed immediately with arsenical wash such as lead arsenate powder, 1¼ lbs. to 40 gallons of water.

Cabbage Family.—Young plants of this family should be kept sprayed with an arsenical wash to check attack by web-worms. The formula given

for potatoes with the addition of ½ to 1 lb. of spreader to every hundred gallons of spray should be effective. If cabbage louse is also present add tobacco extract, 1 part to 80 parts spray. Do not spray plants of which the foliage is to be eaten within three weeks.

Citrus Trees.—May be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine tobacco wash or Derris.

Guava.—Collect and destroy remnants of late crops to keep down citrus codling, especially if trees are in vicinity of citrus orchards.

FLOWER GARDEN.

Complete digging or forking over the soil as early as possible. Divide and replant dahlias, delphiniums, Shasta daisies, etc. Plant bulbs—tuberose, arum lilies and gladioli. Sow seeds of hardy annuals. Mulch newly-planted roses, shrubs, etc.

VEGETABLE GARDEN.

Plant out asparagus, cabbage, cauliflowers, onions and early potatoes. Sow seeds of tomato and other plants that are susceptible to frost in a sheltered position; also seeds of various vegetables and salads for summer use.

FORESTRY.

Cuttings of ornamental shrubs, roses, etc., struck in sand last month should be transplanted into good soil as soon as they show a good healthy growth of leaves. A large percentage of cuttings will damp off if left in sand longer than about six weeks. No manure should be added to the potting soil. Seed beds should be prepared and gum seeds sown if required for planting early in the season. If the trees are to be grown in seed beds only and not in tins, then gum seeds should not be sown until October, or later, as they will get too large.

GENERAL.

Fire guards should be completed and every precaution taken to guard against loss of grazing from fires. Natives commence ploughing their softer land this month, and for this reason, as well as because beer is plentiful at the kraals, local labour is apt to be scarce. At this time of the year, however, the need for boys on farms is not so severely felt as later on.

POULTRY.

By the end of this month all those who are not able to give much attention to the chicks while in the growing stage should have stopped hatching. Those who can give some extra care, can continue hatching for another month, but not later, for chicks hatched after August are usually slow in growth and weedy. They do not lay till some months after they should, and eggs are few in number; in fact, they are generally unprofitable.

Now that the hot weather is approaching, a constant war on insects must be carried out, and of these sand fleas and fowl ticks (erroneously called tampans) will be found to be the most troublesome. A bulletin on fowl ticks can be obtained upon application to the Poultry Expert, Department of Agriculture. Sand fleas, as most poultry keepers know, are found on the face, wattles, ear-lobes and combs of the birds. Application of carbolised vaseline will usually kill them at once, or two or three applications of any ordinary grease on successive days are efficacious. More than this is, however, necessary, for the breeding quarters of these insects (and they multiply very rapidly) are in the dust on the floor of the house and that of the run.

The best preventive is a hard floor (preferably of concrete) with no cracks. If this is not possible, the floor and around the house should

be treated every week in one of the following ways:—(1) Thorough soaking with a solution of one teacupful of Kerol, Jeyes, Hycol, Izal, or similar disinfectant to a paraffin tin of water, or (2) with a strong solution of salt and water, or (3) dusting over and raking into the soil a mixture of one part flowers of sulphur and two parts finely powdered lime.

Ducks.—See that the breeding ducks have plenty of water, and if possible also some to swim in. Keep young ducklings out of the hot sun, otherwise there will be many deaths. The same applies to geese and goslings.

Turkeys.—Young turkeys must be protected from cold at night, for this is fatal to them. Give them as much free range as possible, and do not allow them to run round the house or on the same ground as fowls do. Turkeys like clean ground; any that is tainted is very detrimental to them. Let them find most of their food in the bush.

STOCK.

Cattle.—On the early granite and sand veld probably the worst of winter is over so far as grazing is concerned, and a nice bite of green grass is appearing. Care should be taken where cattle are allowed to graze on the early burnt grass not to let them get too much at first. On red soil farms the haystack will still be required, and in all cases a certain amount of hay or ensilage should be held in reserve against the possibility of very late rains. In dairy herds on any soils whatever, feeding, housing and bedding should not be relaxed. A satisfactory ration for a medium producing cow in full milk is 5 lbs. of maize, 30 to 40 lbs. of ensilage or pumpkin and 8 to 10 lbs. of hay. If it is possible to give, in addition to the above daily ration, 2 lbs. of ground nuts, crushed with the shell, or oil cake, a very great benefit will be derived. Full particulars of the rationing of dairy cows can be obtained on application to the Department of Agriculture. Calves, especially young ones, must be carefully watched; they should not run too far, and are better inside, except when the weather is warm. They should be fed a little sweet hay, bean meal, linseed, ground nuts or ground nut cake and a small ration of green food.

Sheep.—Sheep should give little trouble at this time of the year. In many places now they will be grazing on the early "burns." The ewes and lambs should be given the best grazing available.

TOBACCO.

The seed bed site should be cleared and well ploughed, preparatory to burning and sowing. The usual date of sowing the first beds is the 15th September. Bulletins covering every phase of tobacco culture can be had upon application to the Editor.

VETERINARY.

Redwater and gall-sickness occur all the year round, although these diseases are more prevalent during the summer months. A good many deaths occur this month, however, amongst imported stock. Vegetable poisoning will probably be in evidence. Sheep can be inoculated against blue tongue. Scab is a poverty winter disease.

WEATHER.

No rain is to be expected, and even on our eastern mountains the precipitation is trifling. Showers, however, do occasionally fall in places, but are of no consequence. The sun is often warm during the day, but the nights are apt to be cold, and grazing being scarce, food and shelter are necessary for the stock.

SOUTHERN RHODESIA VETERINARY REPORT.

April, 1932.

AFRICAN COAST FEVER.

Melsetter District.

Roede Farm.—No deaths. The cattle were temperatured and removed to Welgelegen Farm. Several animals showing a rise in temperature were destroyed, but smears from these showed no evidence of the disease.

Rocklands Estate.—The mortality to the end of April was: Constantia, 101; Clifton, 7. This outbreak is attributed to an exchange of cattle from Tilbury Estate in 1931. After the discovery of the Tilbury outbreak, these cattle were temperatured without disclosing any signs of the disease, but previous to this three oxen had died, two of which were from gall sickness, but the carcase of the third was found putrid, and the death may have been caused by Coast Fever.

The Constantia and Clifton herds are being isolated and dipped separately from the other herds on the estate.

Sawerombi.—Four cases were diagnosed on this farm in cattle previously moved from Rocklands Estate.

Melsetter Commonage.—No further cases.

Springvale.—The remainder of the herd on this farm were slaughtered.

FOOT AND MOUTH DISEASE.

Gwelo Veterinary Area.

Selukwe District.—The disease extended to the farms Umlangana and Dorset, adjoining the infected farm Adamantia; later, the cattle on Aberfoyle Block were found to be

infected; these are being inoculated with the cattle on adjoining farms, which are being dipped together.

UMVUMA VETERINARY AREA.

Chilimanzi District.—Infection is spreading very slowly within the Central Estates and is very mild in character. The farms Smithvale and Makanya, also the Chilimanzi Reserve, are now clean.

Charter District.—The farms Opal and Versailles are now clean, and no active centre exists in this district.

VICTORIA VETERINARY AREA.

Victoria District.—The disease has not spread, and the only infected areas now existing are the Mtilikwe and Nyadjena Reserves and the eastern sections of the Nuanetsi Ranch in this district.

BULAWAYO VETERINARY AREA.

Belingwe District.—The farms Grimstone, Dumbarton and Lukotsi became infected, and all the cattle from these and the adjoining farms, numbering over four thousand head, were removed into the Belingwe Reserve to be inoculated. The infection also appeared in Liebig's Wedza Block, Sub-Camp VII., which had not been previously infected.

Insiza District.—Infection appeared on the farm Indhlela, and the cattle on this and the two farms on either side were removed south into the Belingwe Reserve for the purpose of inoculating them.

TRYPANOSOMIASIS.

Nineteen cases were diagnosed on the Eastern Border, Melsetter district, and twelve in the Bubye district.

HORSE-SICKNESS.

The following deaths were reported:—Lomagundi 1, Bubye 1, Inyati 1, Insiza 2, Bulawayo 3, Plumtree 6, Gwelo 1, Chilimanzi 1, Victoria 2.

MYIASIS (SCREW WORM IN CATTLE).

This has been very prevalent.

IMPORTATIONS.

From the Union of South Africa: Bulls 2, heifers 9, horses 8, sheep 1,553, goats 227, pigs 24.

EXPORTATIONS.

Nil.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA WEATHER BUREAU.

MAY, 1932.

Pressure.—The barometric pressure was generally considerably above normal. A remarkably deep low passed along the south coast on the 24th, 25th and 26th of the month; it did not move up the coast, and conditions were only affected very slightly in Southern Rhodesia.

Temperature.—Owing to the prevalence of cloud the maximum temperatures were low and the minimum temperatures high; on the mean, the month was cool. Frost was almost completely absent.

Rainfall.—Slight rains were recorded at most stations.

MAY, 1932.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen ° F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet).
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal.	No. of Days.	
Bulawayo ...	873.4	871.5	79	45	70.0	49.8	59.9	61.1	59.1	52.7	65	48	5.4	0.32	0.4	6	4,436
Gwelo	866.9	...	78	41	69 2	48.3	58.8	60.8	58.6	51.7	63	46	5.2	0.10	0.3	1	4,632
Riverbank ...	...	...	86	44	75 8	49.7	62.8	62.6	59 5	53.5	67	48	...	0.08	0.7	3	4,100
Essexvale ...	...	...	90	42	76.5	49.2	62.9	62.0	54.3	51.6	83	49	...	0.71	0.5	6	3,828
Gwanda ...	912.0	...	83	40	72.8	51.1	61.9	...	61.4	55.4	68	51	4.4	0.75	0.3	5	3,235
Mazunga ...	954.4	952.6	91	42	80.4	52.8	66.6	65.7	65.0	58.4	67	54	4.9	0.54	0.5	5	1,970
Nuanetsi ...	...	...	90	43	82.9	52.0	67.5	..	62.0	57.6	76	54	5.0	0.32	0.4	7	1,630
Between Rivers	...	...	86	41	77.1	48.2	62.7	...	58.5	54.6	78	52	3.1	0.28	0.1	6	3,970
Enkeldoorn ...	...	...	78	44	69.0	48.6	58.8	60.9	58.8	53.4	70	49	4.5	0.35	0.3	6	4,720
Gatooma ...	...	...	83	43	75.5	48.7	62 1	64.2	62.4	55.9	66	51	3.8	0.10	0.3	2	3,850
Miami	...	...	80	45	73.2	52.3	62.8	...	62.4	56.6	70	53	3.7	...	...	...	4,090
Salisbury ...	859.1	858.1	80	43	71.9	49.4	60.7	61.0	60.4	54.0	66	49	4.0	0.39	0.3	3	4,830
Sinoia, Citrus ...	...	...	83	43	76.7	50.1	63 4	...	60.6	55.9	75	53	...	...	0.4	...	3,830
Sipolilo... ...	...	...	82	44	73.3	53.1	63.2	...	63.5	56.8	66	52	2.6	0.41	0.5	3	3,900
Mtoko	...	...	76	49	72.1	52.6	62.4	...	61.5	56.3	72	52	2.8	0.33	0.4	1	4,210
Shamva ...	...	...	84	45	77 3	51.0	64.2	...	63.7	58.3	72	55	2.6	0.20	0.4	1	3,170
Angus Ranch ...	...	...	85	50	76.0	55.7	65.9	65.4	61.8	57.9	79	55	...	0.51	0.2	7	2,300
Craigendoran ...	...	...	83	44	75.3	52.2	63.8	...	63.9	58.7	73	55	...	0.08	0.4	3	3,430
New Year's Gift	...	...	83	50	74.3	53.7	64 0	...	60.7	57.0	80	54	...	0.81	0.5	7	2,700
Nyamasanga ...	...	...	77	44	68.9	48.1	58.5	...	60.2	54.1	67	50	...	0.97	...	7	5,080
Riverdene North	...	...	84	37	73.2	45.6	59.4	...	55.4	53.1	86	51	...	0.84	0.4	9	3,700
Stapleford ...	...	...	70	35	61.8	44.5	53.2	...	55.6	52.3	80	49	4.6	1.18	1.3	11	5,450
Umtali	898.0	895.7	81	46	70.5	52 2	61.4	62.6	61.7	57 6	78	54	5.0	0.85	0.5	8	3,677
Victoria ...	901.6	899.3	80	41	70.5	48.0	59.3	59.9	58.5	54.8	80	53	4.8	0.81	0.4	9	3.570
Melsetter ...	854.6	...	74	45	65.4	49.5	57.5	...	58.2	53.6	74	50	3.7	3.25	1.0	8	5,060
Mount Selinda	...	...	77	48	67.5	52.2	59 9	...	58.2	55 9	87	54	4.1	3.12	1.6	8	3,520
Manchester ...	...	...	72	41	64.0	47.8	55.9	...	51.2	50.0	92	49	...	0.73	...	8	...

DEPARTMENTAL BULLETINS.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.

No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.

No. 429. Propagation of Kudzu Vine, by H. C. Arnold.

No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.

No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.

No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.

No. 550. Onion Growing under Irrigation, by C. Mainwaring.

No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.

No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.

No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.

No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.

No. 630. The Storage of Seed Potatoes, by H. C. Arnold.

No. 634. Barley, by P. V. Samuels.

No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.

No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.

No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.

No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.

No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.

No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.

No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.

No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.

No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).

No. 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16 ft., by B. G. Gundry.

No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.

No. 671. Wildfire and Angular Spot of Tobacco, by J. C. F. Hopkins, B.Sc., A.I.C.T.A.

No. 679. Tobacco Culture in Southern Rhodesia: The Harvesting and Curing of Virginia Tobacco, by D. D. Brown.

No. 715. Turkish Tobacco Culture in Southern Rhodesia, by D. D. Brown, Chief Tobacco Expert.

No. 728. Suggested Crop Rotations for Tobacco Growers, by D. D. Brown, Chief Tobacco Expert.

No. 734. Common Faults in Curing Virginia Bright Tobacco, by D. D. Brown, Tobacco and Cotton Expert.

No. 746. The Development of the Tobacco Industry in Southern Rhodesia. A Historical Survey, by D. D. Brown, Chief Tobacco Expert.

No. 748. Frog Eye Disease of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.

No. 753. Leaf Spotting of Tobacco caused by Mosaic, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.

No. 771. Dark Fire-cured Tobacco: Field Operations, by D. D. Brown, Chief Tobacco Expert.

No. 774. Dark Fire-cured Tobacco: Harvesting and Curing, by D. D. Brown, Chief Tobacco Expert.

No. 784. Field Control of Frenching in Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.

No. 812. Selection of Tobacco Seed Plants, by H. F. Ellis, M.Sc., B.Sc. (Agr.), Tobacco Adviser.

No. 828. Seed-Beds, by D. D. Brown, Chief Tobacco and Cotton Expert.

No. 835. Tobacco Culture—Transplanting Operations, by D. D. Brown.

No. 839. Tobacco Experiment Station, Salisbury—Report of General Crop Experiments, by C. A. Kelsey Harvey, Manager.

No. 840. Curing Tobacco by the Leaf Method *v.* Curing on the Stalk, by W. Collingwood-Evans, B.Sc. (Agr.).

No. 846. Leaf Curl in Tobacco, by Dr. H. H. Storey.

No. 850. Pests of Stored Tobacco in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.

Handbook of Tobacco Diseases in Southern Rhodesia, by J. C. F. Hopkins, B.Sc., A.I.C.T.A. Price 3/6 post free from Accountant, Department of Agriculture, Salisbury.

LIVE STOCK.

No. 338. From Breeder to Butcher; Beef Experiment No 5, by E. A. Nobbs, Ph.D., B.Sc.

No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.

No. 421. From Breeder to Butcher; Cattle Feeding Experiment No. 9, Government Experiment Farm, Gwebi, by E. A. Nobbs, Ph.D., B.Sc., F.H.A.S.

No. 446. From Breeder to Butcher; Cattle Feeding Experiment No. 11, Government Experiment Farm, Gwebi, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S.

No. 468. From Breeder to Butcher; Cattle Feeding Experiment No. 13, by Eric A. Nobbs, Ph.D., B.Sc.

No. 483. From Breeder to Butcher; Cattle Feeding Experiments Nos. 14 and 15, Government Experiment Farm, Gwebi, by Eric A. Nobbs, Ph.D., B.Sc.

No. 624. The Construction of Dipping Tanks for Cattle (Revised).

No. 701. Feeding Bullocks at Gwebi, by S. D. Timson, M.C., Dip.Agric.

No. 719. Hand-rearing of Calves (Revised), by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.

No. 720. Fattening for Beef at the Gwebi Farm, by H. G. Mundy, Chief Agriculturist, and T. J. Needham, Accountant, Agricultural and Veterinary Departments.

No. 737. Fur and Wool-producing Rabbits, by Captain Edgar S. Everett, Hovere Farm, Banket.

No. 749. Dehorn your Commercial Cattle, by W. Fleming, Stock Adviser.

No. 755. Iodine in Animal Nutrition, by J. Park Hamilton, District Veterinary Surgeon, Gwelo.

No. 801. Sheep Farming in the Melsetter District, by J. C. Kruger, Part-time Sheep Adviser in the Melsetter District.

No. 845. The Raising of Bacon Pigs, by Dr. A. E. Romyn, Senior Animal Husbandry Officer; C. A. Murray, Lecturer in Animal Husbandry, Matopos School of Agriculture, and D. A. Lawrence, Veterinary Research Officer.

Arsenite Cattle Dip—How to Mix.

DAIRYING.

No. 520. Treatment of Gassy Curds in Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D.

No. 530. The Dairy Industry: Causes of Variation in Cream Tests, by T. Hamilton, M.A., N.D.A., N.D.D.

No. 577. Cream Cheese, by J. R. Corry, B.Sc. (Agr.).

No. 594. Milk Recording and its Advantages, by T. Hamilton, M.A., N.D.A., N.D.D. Introduction by J. R. Corry, B.Sc.

No. 667. Farm Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.

No. 703. Dairy Buildings in Southern Rhodesia: Cow Byre—Type II., by B. G. Gundry, Irrigation Branch.

No. 711. Dairy Buildings in Southern Rhodesia. A Small Farm Dairy, by B. G. Gundry, A.I.Mech.E.

No. 717. Gouda or Sweet Milk Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.

No. 730. Common Defects in Butter-making, by T. Hamilton, M.A., N.D.A., N.D.D., and J. R. Corry, B.Sc. (Agr.), Dairy Experts.

No. 785. Bacon Curing on the Farm, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.

No. 792. The Feeding of Dairy Stock in Southern Rhodesia, by T. Hamilton, M.A., N.D.A., N.D.D., and J. R. Corry, B.Sc. (Agr.), Dairy Experts.

No. 799. The Objects of Ripening Cream for Butter-Making, and a few Hints on Cream Production, by F. Lammas, Dairy Officer.

No. 818. Farm Butter-making—Issued by the Dairy Branch.

No. 844. Southern Rhodesia Milk Recording Scheme.

Points to be observed in Cream Production.

VETERINARY.

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THE RHODESIA

Agricultural Journal.

Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).

PUBLISHED MONTHLY.

Subscription: 5/- per annum; payable to the Accountant, Department of Agriculture, Salisbury.

VOL. XXIX.] AUGUST, 1932. [No. 8

EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Official Year Book.—The third number of the Official Year Book of Southern Rhodesia has just appeared. The first was published in 1924 and the second in 1930.

It contains about 800 pages, and the Government Statistician is to be congratulated upon the selection and arrangement of the material presented.

It has been found necessary for considerations of economy to omit a number of articles which appeared in the 1930 edition, but a number of new articles, charts and maps have been included, so that it is similar in size to the 1930 number.

Most of the sections are brought up to the end of 1931, with the exception of the tabular statistics, for which the 1931 figures were not complete when the publication went to press.

It is obtainable from the Department of the Controller of Printing and Stationery or the office of the Government Statistician, and the price is 5s.

Price of Crown Land.—During the last session of the Legislative Assembly, Mr. C. S. Jobling, M.L.A., moved:—

> "That this House urges upon the Government that it takes into immediate consideration the necessity for a reduction in the price of Crown land in order to bring about some correlation between such price and the present values of agricultural and pastoral products."

The Government accepted Mr. Jobling's motion, and a committee is now being appointed under the chairmanship of the Director of Agriculture.

The terms of reference are as follows:—

1. (a) The prices charged for all Government land held under Permit of Occupation, Agreement of Purchase or lease as at 1st April, 1932.

(b) Price to be charged for Crown land still available.

2. Consideration of the necessity for a reduction in the prices of such land, based upon:—

(a) size of the farms;

(b) average quality of the land;

(c) estimated value of, say, tobacco land, mealie land, grazing lands, taking into account the proximity to the railway.

3. A consideration of terms of payment.

4. A consideration of interest charges in relation to all land comprising classes 1 (a) and 1 (b) above.

5. Recommendations regarding interest.

Since this subject has been widely discussed by farmers and Farmers' Associations, there is no doubt that a number of farmers would like to present their views personally to the Committee; it is therefore requested that all such persons should write to the chairman indicating what points they wish to bring forward and what date would be suitable for them to appear.

Celery Growing.—An important addition to the literature on celery growing is provided in Bulletin No. 47, of the Ministry of Agriculture and Fisheries, published in April this

year. It outlines the method of culture adopted by the specialist growers in the chief celery-growing areas, and also the results of investigations into celery culture made by the staff of the Midland Agricultural College.

After discussing the extent of the industry, soil and climate, suitable varieties and seed saving, the bulletin goes on to describe the methods of celery growing in the Isle of Axholme. This district is by far the most important, and it is claimed that the specialised technique of celery-growing was evolved and perfected in this area.

The points dealt with include manuring, seedling raising, dressing seed, sowing, bedding-out, spraying, field planting and cultivation, top-dressing, bleaching, lifting and marketing.

The bulletin has 17 pages of text and 10 illustrations, and is obtainable from H.M. Stationery Office, Kingsway, London, W.C. 2, at 7d. post free.

Recipe.—The following recipe for buttermilk cheese has been kindly supplied by Miss Barbara Gibbs, of Bonisa, P.B. Redbank, Bulawayo:—

> *Bonisa Buttermilk Cheese.*—Keep buttermilk for one day, then stand on stove in bowl till it "comes up" like Devonshire cream. Strain through butter cloth and hang up till the whey is all gone. Press between plates with weight on top. Not to be kept long.

Publicity.—The first All-British and Empire National Grocery, Provision and Allied Trades Exhibition ever organised in England was held at Olympia from 21st May to 4th June, 1932.

The last day of the Exhibition was set aside as a Southern Rhodesian and East African day, and the opening was performed by Sir Edward Greig.

The Southern Rhodesian display was in the charge of Mr. A. J. Bouchier and attracted considerable interest.

A special feature was made of maize and maize products manufactured from Rhodesian grain, and the different types of leaf tobacco were exhibited in addition to the numerous brands containing Rhodesian leaf.

Numerous illustrations were shown depicting the cultivation of tobacco, maize and citrus fruits in the Colony, and the various exhibits were favourably remarked upon by a large number of those visiting the stall.

A Green Manuring Experiment.—The following notes regarding a green manuring experiment which was carried out by a farmer in the Enterprise district will be read with interest.—Ed.

"On this farm maize is rotated every fourth year with dolichos beans as a green manuring crop. Last season, 1930-1931, the beans were under-sown thinly among the third crop of maize and were not harvested, with the result that a heavy crop of volunteer dolichos made its appearance with the first rains in October, 1931, on a 40-acre block destined for green manuring. The land had not been ploughed since the previous May, and the only treatment the volunteer beans got was a hand-hoeing twice. By the end of December, 1931, so vigorous a growth of tops had been made, accompanied by prolific nodules on the roots, that the entire crop was ploughed under and the land immediately resown to dolichos beans in January, 1932. This second crop had a slight setback from leaf-curl, which seemed to be prevalent everywhere, but this disappeared as the season advanced, and a very satisfactory second crop of dolichos ensued. So much so that at the beginning of April three courses were open to me: the beans could be left to seed, the crop could be cut for hay, or the whole could be grazed as it stood.

As the veld deteriorates steadily from April onwards, it was decided to utilise 20 acres for grazing for a small dairy herd (30 head including calves), and to reserve the remaining 20 acres for seed. The herd was allowed to graze for a few hours only each day, but the improvement in condition and milk yield was quite marked. The seed is ripe at the time of writing and promises a good return, and after this

is harvested these vines will be utilised for grazing and will probably last until the maize stalks are available.

Now this procedure opens up an alternative method of green manuring which has obvious advantages, particularly on those farms where feeding for cattle is a consideration:—

(i.) Two lots of roots with their nodules are ploughed under in addition to the available tops.

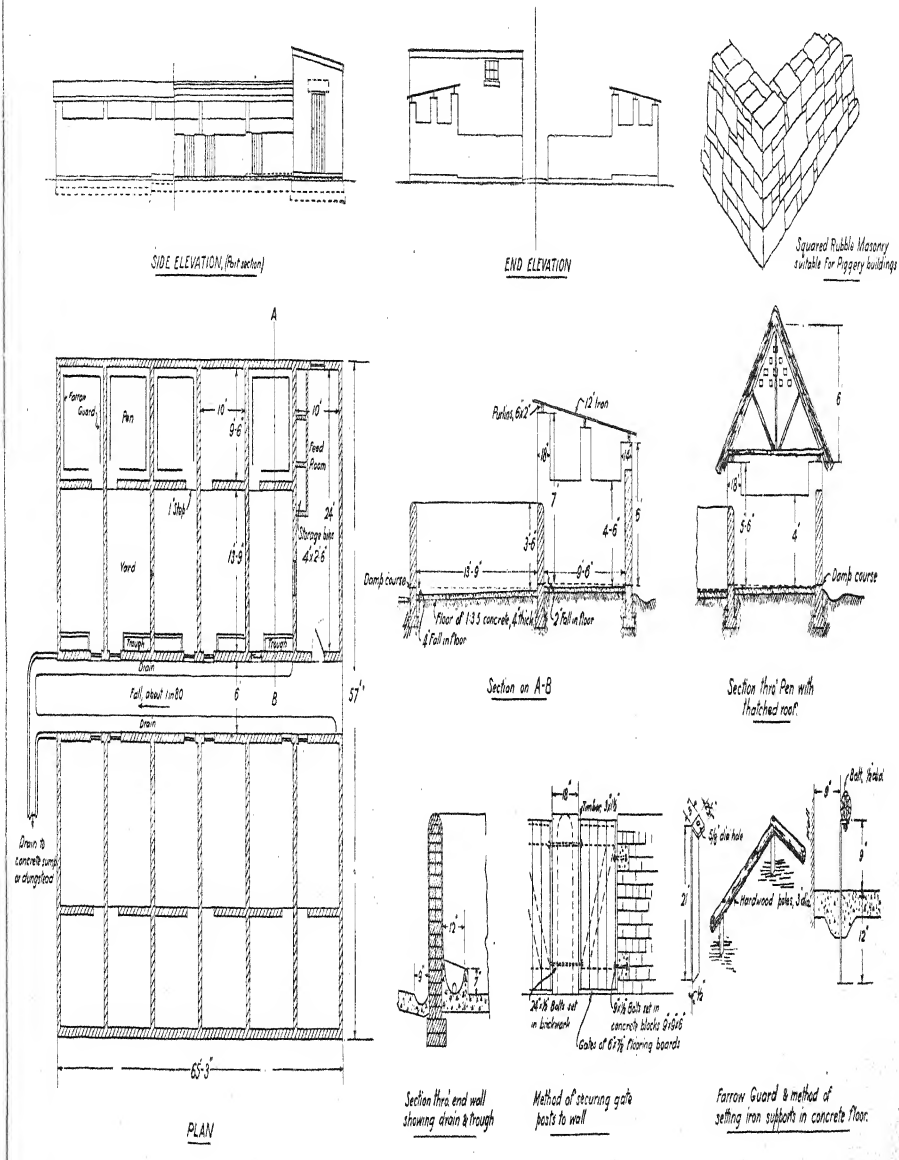
(ii.) Ploughing in October is obviated, being replaced by a ploughing in December when the oxen are less busy.

(iii.) A crop of leguminous hay can be cut in April or May, or the beans may be harvested, or the crop may be utilised as grazing at a time when the veld deteriorates in value and the maize stalks are not yet available.

(iv.) Some return is being obtained from a plot when it is being green manured, in the form of grain or fodder.

This plan would, of course, not be feasible where sunn-hemp was used, but it could be practised in the case of velvet beans, dolichos or cowpeas. In any case the results have been so satisfactory this year that I propose continuing it in future years, with possibly some variations such as using the earlier maturing cowpea as a second crop, and by planting the first crop of dolichos dry in September or October."

PLATE 1.



DESIGN FOR PIGGERY

Central Housing System

Irrigation Division

PIGGERIES.

By B. G. Gundry, A.I., Mech., E.

In the following pages it is proposed to describe the construction of a simple type of permanent central piggery, and also temporary and portable houses for use in paddocks where pigs are run on the colony system.

The general type and design of the buildings and accessories described are based on the recommendations of the Division of Animal Husbandry.

Site.—In selecting a site for a permanent piggery such as is shown in Plate 1, preference should be given to a piece of well-drained ground having an even fall of about 1 in 80 to facilitate drainage.

If possible, the site should be to the leeward of the main homestead, within easy reach of the dairy and feed grinding floor, if such are in existence.

Coolness is an essential factor to be considered, and the piggery should not therefore be shut in by other buildings or dense trees. While a certain amount of shade is desirable, sunlight should not be entirely excluded, particularly in the early morning hours. It is an advantage to have the piggery in close proximity to some permanent pasture with a few shady trees, in which the pigs can be turned out to graze. A suitable spruit of running water, in which they can wallow in hot weather, is also an asset, but, of course, the pigs must not be allowed to pollute a neighbour's water supply.

Foundations.—Having selected the site and decided on the number and arrangement of the pens to be built, the foundation trenches may be pegged out. In order to get the angles square, it is advisable to set them off with a wooden triangle made from floor or ceiling boards, with sides

of 6 ft., 8 ft. and 10 ft. respectively. If accurately made, the angle opposite the longest side will be a right angle.

On a good compact formation, the trenches should be dug 12 ins. deep, but as the ground surface is, or should be, sloping, and the bottom of the trench must be kept level, it will be necessary to step them down by the thickness of one brick at the necessary intervals to keep the trenches at the proper depth throughout. It will be convenient to make these steps to correspond with a division wall in the pens, as will be seen in the side elevation of the piggery illustrated in Plate 1.

The width of the trenches should be 6 to 9 ins. wider than the maximum width of the foundation. The bottom of the trenches should be quite level, and when finished should be tamped evenly all over to thoroughly consolidate the sub-soil.

The foundations themselves may be built of hard, well-burnt bricks, stone or concrete.

The lower courses should be at least 50 per cent. wider than the thickness of the walls they are to support, except for the feed room or other building, the walls of which are to be more than 6 or 7 ft. in height, where they should be twice as wide as the thickness of the walls.

The foundations, which comprise all the work below the damp course, whether of brick or stone, should preferably be laid in 1 to 5 cement mortar. A cheaper alternative is to use a lime mortar mixed in the proportion of about 1 part lime to 6 parts of sand. The durability of this mortar can be considerably increased by the addition of 10 per cent. of cement, which should be added to small batches of the mortar immediately before it is used. Under no circumstances is the use of dagga recommended for laying foundations.

If, in exceptional circumstances, it is decided to use concrete for the foundations, the trenches should be neatly excavated to the exact width the foundations are to be. The concrete, mixed in the proportion of 1 part cement 3 parts sand and 6 parts stone, is then placed in a layer about 4 ins. thick and tamped down. The foundations can then be completed to the damp course level in brick or masonry as described above, or, if they are to be completed in concrete,

shuttering must be arranged in which to mould the concrete to the height and thickness desired.

Damp Course.—A layer of material impervious to moisture and "white ants" must be placed on the completed foundations. A bitumastic fabric known as damp course felt, or 26-gauge galvanised iron, are the materials most commonly used for this purpose. A layer of cement mortar only is not considered satisfactory, as it is liable to crack and is not entirely damp-proof. There is little difference in the cost of iron and felt—the latter is more easily cut and handled, but the former is probably the more durable. If iron is used, it must be cut into strips the same width or a little wider than the top of the foundation. The strips are joined end to end either by overlapping them by about 3 ins. and soldering them together over the full width, or by hooking the ends together and hammering them flat, care being taken not to damage the galvanising.

If lime mortar has been used in the foundations, the top course of brick or stone should be covered with a thin layer of 1-5 cement mortar before an iron damp course is placed in position, as lime reacts on the galvanising and eventually destroys it. For the same reason cement mortar should be used for laying the course immediately above the iron. No such precaution need be taken if felt is used. This material is cut into strips of the necessary width and any convenient length, and where these join they should overlap by at least 6 ins. It will be seen from the drawings that the level of the damp course is approximately 6 ins. above the adjacent ground level at the back of the pens, and is stepped down one course at the walls dividing the pens from the yards.

The surface of the floors should be level with, or rather below, the damp course.

Walls.—The walls may be of brick or masonry. The former should be all 9 ins. thick, but the latter will require to be somewhat thicker, those on the outside being from 15 to 18 ins. thick and the division walls from 12 to 15 ins., according to the size and shape of the stones available.

The type of bond known as "squared rubble" is recommended in preference to "random rubble," which, when

attempted by the ordinary native builder, is apt to degenerate into a mere untidy pile of stones possessing neither strength nor durability.

It will be noted that a fair proportion of the stones should occupy the full width of the wall, like the "headers" in a brick wall. Only hard, sound stones should be used, and they should be laid on their natural beds, i.e., with the grain or laminations, if such are visible, lying horizontal.

Lime mortar mixed in the proportions of 1 part lime to about 6 parts of sand is recommended for laying either bricks or stones, but on account of its cheapness, dagga is likely to be more popular. It must be remembered, however, that while dagga is quite satisfactory if kept dry, it becomes useless if moisture is permitted to penetrate into the wall. A large proportion of the walls in a piggery have no roof to protect them, and it is therefore necessary to take particular care to render them perfectly weather proof. The surest method of doing this, particularly with brick walls, is to plaster them with 1 to 4 cement plaster, to which a half part of well slaked lime may be added to make it work more easily and to render it somewhat more waterproof.

The top of the exposed walls should be rounded as shown in the cross-section of a wall on Plate 1.

The brickwork should be kept slightly damp as the plastering proceeds, so that the plaster is not dried out too quickly and spoilt.

Masonry walls built of comparatively small stones should also be plastered, the dagga joints being first raked out to a depth of about an inch in order to give a key for the plaster.

Walls built of large, well-shaped stones are better left unplastered, but the joints must be raked out to a depth of 1 in. and pointed with a 1 to 3 cement mortar, great care being taken that no small holes are left into which rain can penetrate. The tops of such walls should be plastered and rounded off with the same mixture.

Floors.—The floors should be of either stone or concrete. Cement-plastered brick floors are not recommended owing to their liability to crack and their inability to withstand the wear and tear to which they are subjected.

If flat slabs of hard stone are available, they make an excellent and cheap floor, but they must be very evenly laid so that rain water and urine cannot collect in puddles. Before any stones are laid, the original ground surface must be brought to the proper height and slope and tamped solid.

Each stone must be carefully bedded down on a layer of sand about 1 in. thick by a few blows with a heavy piece of timber. A row of stones should first be laid down each side of the pen or run, particular care being taken, with the aid of a straight edge, to see that they are evenly laid to the correct slope. These two rows can then be used as a guide for the straight edge, which, when resting with one end on each row, can be used to test the intermediate stones as they are laid. Particular care must be taken to avoid any depressions in the corners or sides of the pens or yards, and to avoid this it is as well to allow the floor to slope very slightly from the sides towards a small depression about half an inch deep running from the entrance to the pen to the hinge side of the gate in the yard, but the formation of an actual gutter should be avoided.

A space of about half an inch should be left between adjacent stones, which, when the floor is otherwise finished, is filled in with a grouting mixture of 1 part cement to 3 parts sand. This should be fairly liquid, so that it can be thoroughly worked in to all the joints with the point of a trowel, the object being to prevent water soaking through the floor.

There should be a step about 1 in. deep between the pen and the yard to ensure that during a heavy downpour of rain, water cannot flow back from the yard into the pen.

Before a concrete floor is laid, the ground surface should be prepared as previously described, but if possible a layer of gravel or hard broken bricks a few inches thick should be laid down first and tamped solid.

As no delay must take place when the concrete is being placed, use must be made of level pegs. These pegs, which should be about 1 in. diameter, are driven into the ground in straight lines about 3 feet apart each way, so that the top of each peg is exactly at the height which the surface of the floor is to be at that particular spot. Their height should be carefully checked and adjusted with a straight edge so

that the floor will be at the correct grade. The same care should be taken to make a slight depression to localise the drainage, as explained in the case of stone floors.

The concrete should be of the proportions of 1 part cement, 3 parts sand and 5 parts aggregate, i.e., broken stone. In order to obtain a hard wearing surface, it is best to finish the concrete with a sufficiently even surface so that plastering or "topping" is unnecessary. In order to do this, particular care must be taken to obtain a well-graded aggregate. This should consist of sound, hard stone such as granite or quartz broken into various sizes, from those which will just pass through a three-quarter inch diameter ring down to a coarse sand, the proportionate number of the different sizes being such that they pack together to form a dense mass. All oxidised or friable stone should be discarded.

The ingredients of the concrete must be mixed thoroughly before and after the water is added. It must be remembered that the setting of cement is a chemical reaction which commences about 30 minutes after the water is added, and each batch should be mixed, placed and finished off within that time, if the full strength of the concrete is to be obtained. The concrete must be placed as evenly as possible and rammed down level with the tops of the pegs with a rammer having a face about 6 to 8 ins. square, covered with metal. If it is found that in places the sand and cement do not work up sufficiently round the aggregate to form a fairly smooth surface, a small quantity of mortar consisting of 1 part cement to 3 parts of coarse sand may be placed on the bad patches and tamped in.

This same mixture may be used for filling in the holes left by the level pegs, which are removed as soon as the concrete immediately surrounding them is completed. To facilitate their removal they should be slightly tapered.

The concrete trough may, if the builder is sufficiently skilful, be roughly moulded integral with the floor and finished off with a 1-3 cement plaster as soon as possible afterwards; otherwise, the space occupied by the trough should be left bare and the trough moulded as a separate operation.

Immediately the concrete is finished, it must be covered with clean grass or old sacks and kept damp as described later in some general remarks on the use of cement.

The feed passage and drains may be constructed either of stone or concrete in the same method as described for the floors.

Roofing.—Corrugated iron or thatch, or a combination of these two materials, may be used for roofing the pens.

Corrugated iron alone has the disadvantage of making the pens rather hot during sunny weather, but in order to overcome this objection, it may be covered with a layer of thatching grass about 3 ins. thick. The iron is supported on three purlines, resting on pillars projecting from the walls dividing the pens, and to which they are anchored by strips of hoop-iron built into the top six courses of brick-work. The purlines may be of 6 in. x 2 in. imported timber, as shown in the drawing, or straight gum-poles having an average diameter of about 4 ins. may be used. In order to give the roof a neat and workmanlike appearance, the upper surface of the poles should be dressed off perfectly level with an adze.

If the iron is to be covered with grass, short lengths of 14-gauge galvanised iron wire should be twisted round the roofing screws before they are driven right home, so that the two ends of the wire, about 6 ins. long, are left with which to tie down the laths or wires which will have to be laid over the grass to keep it in position.

If a thatched roof is to be erected, it should be carried on triangular principles as shown in the drawing; these rest at intervals of three to four feet on bearers running along the front and back of the pens. The purlines may consist of thin straight sticks of native timber or 10-gauge fencing wire spaced 12 ins. apart.

The roof of the feed room, if of iron, is carried by 4½ in. x 1½ in. rafters placed 5 ft. apart, crossed by three lines of 3 in. x 2 in. purlines. A thatched roof would be built similarly to that shown for the pens.

Gates.—The gates for the runs may be made from 6 in. x ⅞ in. flooring, or boards from a heavy packing case. They

should be not less than 2 ft. wide by 3 ft. 6 ins. high. The battens and diagonal brace should be screwed and not nailed to the uprights. They are hinged by two 18 in. Tee hinges to gate posts of 1½ in. x 3 in. timber bolted to the walls. The posts on either side of the division walls, on which the gates are hung, may be conveniently fixed by means of half-inch bolts screwed at both ends, set in the intervening brickwork as shown in the drawing. The opposite posts are best secured by bolts set in small concrete blocks built into the walls. These blocks can be cast in a wooden box, the inside dimensions of which are 9 ins. x 9 ins., and equal in thickness to two bricks, plus the thickness of one mortar joint, which will amount to about 6½ ins. in all. As the concrete is filled in, an ordinary hexagon-headed bolt 9 ins. x ½ in. is set in position so that it projects 2⅜ ins. from the end. The concrete for this purpose should be of 1 part cement, 2 parts sand and 3 parts small stones. When quite set, the blocks are removed from the moulds and built into the wall. As a number of such blocks will be required, a multiple mould should be made with two 9 in. planks standing on edge on a level piece of ground, with division pieces set crossways, making a number of compartments of the required width.

An alternate type of gate may be made with the battens projecting about 1 in. on either side so that they slide up and down either in a groove cut in the gate posts, or between two strips of wood about 1 in. square nailed to each side of the post so that a slot 1 in. wide is left between them.

A piece is cut out of these strips about 6 ins. from their lower end, so that when the gate is raised about 6 ins. and the top batten is clear of the posts the lower batten is opposite this gap and the gate can be entirely freed without lifting it any further. It is secured when shut by an ordinary bolt or a pin, such as a stout nail passed through the end of one of the battens and the post.

This type of gate is not so convenient as the hinged variety, but the cost of the hinges is saved, and they are very secure.

Farrow Guards.—Farrow guards are necessary in the breeding pens to prevent the sow from crushing the young pigs against the walls. The guards may consist of straight

hardwood poles about 3 ins. diameter, bolted to iron supports set in the floor. These supports may be made from old wagon tyres drilled and bent over at the top as shown in the drawing.

If the floors are of stone, it is advisable to leave spaces about 16 ins. square where the supports are to be placed, and when the floor is finished the supports are put in position and secured by filling in the space around them with concrete. If the floors are to be of concrete, the supports are placed in position first by driving them into the ground so that their tops will be at the correct height above the floor. It is advisable to excavate a depression two or three inches deep immediately round the iron so that the concrete is thicker there and holds the supports more securely.

Feed Room.—A suitable building in close proximity to the piggery in which to store and mix the foodstuff is a great convenience.

The floor may be of concrete, or, for cheapness, may consist of bricks laid flat and plastered with 1-4 cement plaster three-quarters of an inch thick. The walls also should be plastered with the same mixture to make the building as vermin proof as possible. A few bins about 4 ft. long by 2 ft. 6 ins. wide and 2 ft. high for the storage of foodstuff are also a convenience. They can be built of brickwork 4½ ins. thick laid and plastered with 1-4 cement mortar. They should have well-fitting lids of wood or galvanised iron to exclude rats, etc.

(To be concluded.)

REPORT OF THE BRANCH OF CHEMISTRY

FOR THE YEAR ENDED 31st DECEMBER, 1931.

General.—The indoor analytical work of this Branch for the past year has been almost exclusively confined to performing the routine work entrusted to its charge. Owing to the reduction of staff experienced throughout the year, occasioned by one member resigning to fill another post, and another leaving for an extended course of further study in the United Kingdom, and the fact that on grounds of economy they were not replaced, it was impossible to carry out any purely chemical laboratory research work.

The routine duties fall under the following heads:—

(1) Analyses of soil samples, waters for agricultural purposes, agricultural limes, manures, agricultural products generally, for farmers and for allied Branches.

(2) Analyses of samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance, 1914."

(3) Cattle dips and toxicological analyses for the Veterinary Department.

(4) Analyses of samples and standardisation of glassware, under the "Dairy Produce Act, 1925," and the "Dairy Industry Control Act, 1931."

Summary of Routine Analyses.—The following table comprises the samples analysed during the year:—

Soils	410
Sub-soils	24
Manures and Fertilisers	45
Farm Foods	43
Cattle Dipping Fluids	30
Toxicological	79
Waters	20
Limestones and Rocks	17
Glassware (standardised)	78
Dairy Products	9
Forensic	5
Vegetable Products	246
Miscellaneous	28
	1,034

It is worthy of note that the grand total of 1,034 represents the greatest number of samples for one year that has so far been dealt with by this Branch, the previous maximum being 937 for the year 1929.

In addition to these actual analyses, much advisory work by correspondence and interview was performed by the senior officers of the staff. Most of this was done for farmers seeking guidance as to correct soil and fertiliser treatment, but very frequently information was requested and given upon problems which are rather outside the normal sphere of an agricultural chemist. Advice, too, was supplied to commercial firms on chemical problems of their own, and there is hearty co-operation between the Branch and other divisions and branches of the Agricultural Department.

Although requests from individual farmers and Farmers' Associations for an officer of the Branch to visit them were quite as numerous as in previous years, very few could be complied with, owing partly to pressure of work with reduced staff, and partly to the necessity at present for cutting down expenses.

Soils.—The 410 soil samples enumerated above include 138 taken in the soil reconnaissance of part of the Inyanda Block, Fort Victoria district, for purposes of reporting on

the suitability of this area as an irrigation project, commonly known as the Umshandige Gorge Project. The samples were taken in October, 1930, and were included in the list for 1930, but their analyses occupied the whole time of two members of the staff for five months of the year under review, the final report being completed in June, 1931. Further reference will be made to this under Investigational Work.

Of the remaining 272 samples, 123 were submitted either in order that we might ascertain by examination and analysis their suitability for tobacco production, or that advice on fertiliser treatment for tobacco might be given; 60 were submitted for report on treatment for maize, and 84 for advice as regards composition and general cropping, or that deficiencies or harmful ingredients might be detected. The fact that nearly 50 per cent. of these samples came from farmers contemplating tobacco-growing, is significant in that it indicates a reviving interest in that crop, due doubtless to the depressed condition of the maize market. There were no enquiries as regards light tobacco—all requests emanated from growers intending to produce the heavier grades.

The remaining five samples received a complete chemical and mechanical analysis in connection with the pasture research experiments.

Manures and Fertilisers.—Forty-five samples of these were analysed during the year under review; of this total, 19 were taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance, 1914." It is gratifying to be able to report that one only of these was found to be below guarantee, and that but very slightly in an unimportant constituent. The vendor concerned was communicated with, and a satisfactory explanation received.

In the year 1928, in order to have more perfect control of the quality of fertilisers and farm foods being sold throughout the Colony, and to ensure that the terms of the Ordinance were being universally complied with, arrangements were made to appoint official samplers at Bulawayo, Gwelo, Gatooma and Umtali. The duties of those appointed are to sample under the Act fertilisers and farm foods being offered for sale in the respective towns, or passing through the railway stations, and to send the samples to

this Laboratory for analysis. A reminder is sent each year, but little notice is taken. For the year under review, four samples only of fertilisers were received from these outlying stations, one from Gwelo, one from Gatooma, and two from Umtali; there were no farm foods. The remaining 15 fertilisers, and all the farm foods, were sampled by officers of the Branch at Salisbury. The position is not a satisfactory one.

Of the remaining 26 samples, 6 were fertilisers analysed for commercial firms and the usual charge was made; 15 were done at the request of farmers wishing usually to know if their stocks had lost strength from a previous year, and how to bring them up to a required strength, if necessary; 5 were miscellaneous manures, including two samples of wood-ashes, also done for farmers.

Farm Foods.—Ten of these were taken under the Act, 33 were from other sources.

Of the 10, two did not conform with their guarantee. To the vendors of one, a strict warning was issued, and a recommendation was made that a prosecution should be instituted against the other firm concerned. This was done, but owing to legal sophistries the case broke down in its preliminary stages. Notwithstanding the advertisement inserted in the newspapers at the end of 1930 calling the attention of vendors of farm foods and fertilisers to their obligation to effect registration each year before 31st March, three firms of six entered for sampling purposes by the officers of the Branch were found to have neglected to do so. This was reported, severe warnings were sent to the firms in question, and registration was effected by them without delay. It is to be hoped that in future steps will be taken to ensure that the regulations as regards registration are strictly complied with, as it is a waste of time and material for this Branch to analyse first, and then have registration effected afterwards; further, it confuses the legal position when a sample is found to be below the guarantee of a registration recorded after analysis.

Twenty-one of the remaining samples were either partially or completely analysed at the request of other Divisions of the Department, 5 were for commercial firms and 7 for private farmers. None calls for special comment.

Cattle Dipping Fluids.—Thirty of these have been analysed and reported upon. The increase in number from last year, when only 17 were done, is due to an arrangement between the Chief Veterinary Surgeon and the Chief Chemist that Cattle Inspectors should forward samples of dip from selected tanks tested by them, together with the result of their tests, in order to standardise their iodine solutions. These samples are analysed at this Laboratory; if the result differs from that given by the Cattle Inspector, he is informed accordingly, and the factor necessary to correct his iodine solution is given him, together with an explanation. In only very rare instances have the Cattle Inspectors been found to be far out with their results.

Nearly all the remaining 13 samples were submitted by officers of the Veterinary Department for analysis, under the "Cattle Cleansing Act, 1927."

Toxicological Analyses.—Deaths of animals due to careless handling of arsenical dips still continue year after year. Last year 67 samples of viscera of animals suspected of dying of arsenical poisoning, or of soils thought to be impregnated with spilt dip were examined, and this year the number is two more. Of the 69 samples examined for arsenic, 27 were found to contain sufficient quantity to cause death, in 9 traces of arsenic were found, and in 33 the presence of arsenic, though suspected, could not be verified on analysis. The poison suspected in the other 10 samples, waters and soils, was cyanide; negative results were obtained except in one instance, the water from the slimes dam of a mine, tested as a precautionary measure.

Waters.—Twenty samples of waters were reported upon, 4 of these being included in the Umshandige Gorge Irrigation Project report. Eight others were subjected to special analysis for the Irrigation Department in connection with soil erosion work, and the others were examined mainly to test suitability for private irrigation work or for suitability for use in boilers.

Limestone and Rocks.—Of the 17 samples sent in under this head, 11 were received from natural deposits found by farmers on their lands. Four of these had a calcium carbonate content of over 70 per cent., and were reported upon

as suitable for agricultural purposes, but the others were poor specimens of low-grade limestones. The remaining 6 were also analysed for farmers wishing to know the exact lime content, as carbonate or quicklime, of samples they had bought from commercial firms.

Glassware.—Seventy-eight cream test bottles were submitted for standardisation as required under Government Notice No. 279. Eight of these did not conform to the standards laid down in this Notice, so were destroyed as per regulation.

Dairy Products.—Nine samples of butter and milk were dealt with, 8 being done at the request of the Dairy Expert, with a view to discovering the presence or absence of preservative. The other sample was one of milk delivered by a local farmer for examination as to normality or otherwise.

Forensic.—For the first month of the year, owing to the absence on leave of the Government Analyst, analyses of five forensic samples were undertaken and completed. Three of these consisted of viscera of dogs taken by the Criminal Investigation Department, and the others were different parts of the viscera of a native suspected of having been killed by poisoning. Positive results were obtained in the former investigation, negative in the latter.

Vegetable Products.—The 246 samples enumerated under this head include 125 analyses of grasses completed by the Chemist seconded for pasture research, each of these analyses involving 13 different estimations. Equally as complete analyses were made of 24 grass samples for the Pasture Research Station at Naivasha, Kenya Colony. Partial analysis was performed on 21 other samples of grass, including five submitted from the Walvis Bay Railway Survey party from N. Bechuanaland, 2 from Rhodes Estate, Inyanga, 7 pure species from the Salisbury Experiment Station, 2 from the Director of Agriculture, and 5 from private farmers.

The majority of these were analysed to determine their feeding value for stock, but no result is worthy of special mention.

Forty-eight samples of maize grain and core were subjected to moisture tests in connection with an investigation

into the effects of potash on the drying-out of maize. Further reference is made to this under Investigational Work.

The juice content of 8 samples of oranges from Mazoe Citrus Estate was estimated at the request of the General Manager, B.S.A. Co.

Other specimens classified under the heading Vegetable Products include tobacco leaves, cotton seed, varieties of oats, silage, m'futi leaves, majorda peels and sunflowers.

Miscellaneous.—The samples included here are 28 in number, and were composed of salt licks from the Game Warden, Wankie Game Reserve, telephone cable from Chief Postal Engineer, eggs from the Poultry Department to be tested for water-glass treatment, oils, barbed wire, clinker, brine, etc.

A sample of soap was analysed under the "Standardisation of Soap Act, 1930"; the miscibility of varying proportions of absolute alcohol and petrol was investigated and reported upon in connection with the power alcohol scheme; an investigation into the bleaching of pea-nuts was carried out at the request of the Chief, Division of Plant Industry, and several samples of bones from diseased and healthy oxen were analysed for the Director of Veterinary Research, in an endeavour to ascertain whether the former had suffered from osteomalacia.

Investigational Work.—As already indicated, the task of coping with the abnormal number of routine samples submitted throughout the year, and the gradual diminution of staff, have rendered the undertaking of much investigational work almost an impossibility. Further, as pointed out in the annual report for last year, we are seriously restricted in our facilities for indoor research work by bad laboratory accommodation and antiquated plant.

1. *Umshandige Gorge Irrigation Project.*—The chemical report on this scheme was issued from this office at the end of June. It embodied the results of seven months' continuous analytical work by one of the staff, and for four of these seven months, two were exclusively engaged on it. Complete analyses were made of 138 samples of soils and subsoils; each one of these involved nine different estimations, as did the analyses of the water extracts of 30 of them which

showed a high percentage of water-soluble salts. Four samples of water taken from the Umshandige River at different times of the year were also completely analysed and reported upon.

The final conclusions were that, of the 4,260 arable acres inspected and sampled, 3,109 acres, not including one farm uninspected nor small isolated areas under 20 acres, were considered, from a chemical and physical point of view, entirely suitable for the purposes of this scheme. These were classified as under:—Irrigability: Class I., 1,221 acres; Class II., 647 acres; Class III., 1,104 acres; Class IV., 705 acres; 568 acres of these were classed as "doubtful" with a warning that care would be necessary in their irrigation.

The final report consisted of 26 pages of type, 22 separate tables of analytical results, and 27 photographs.

It has been decided by the Government to take no steps at present in connection with this project, but the Lands Department has been instructed not to alienate any of the farms affected.

2. *Influence of Potash on the Drying-out of Maize.*—An experiment to determine whether or not potassic fertilisation exercised any influence on the drying-out process of maize in the field was carried out, with the assistance of the Salisbury Experiment Station staff, during the year under review. The description and results of this experiment were published in the December issue of the *Rhodesia Agricultural Journal*. The final conclusions quoted from this article were: "There is no uniformity in the results, and no indication that the application of the potash to the soil has accelerated in any way the drying-out of the grain."

3. *Manuring for Maize Production.*—These trials, which were originated in 1926, to compare the relative merits of raw rock phosphate and bone-and-superphosphate as fertilisers for maize, and which were intended to run for five years, have now been completed. The results obtained from 1926-27—1928-29 inclusive were published in the *Rhodesia Agricultural Journal*, December, 1929. The totals for the three years were, over four 1/10 acre plots, for raw rock 7,292 lbs. per acre, and for bone and superphosphate 6,795 lbs. The yields for 1929-30 were 1,931 lbs. per acre and 1,389 lbs. per acre respectively, and for last year, 1930-31,

958 and 820 lbs. respectively, The grand totals for five years are, therefore, 10,181 lbs. per care for raw rock, and 9,004 lbs. per acre for bone-and-superphosphate, a difference in favour of the former of 1,177 lbs., or nearly six bags per acre in the five years.

The results throughout have therefore been consistently in favour of raw rock phosphate.

4. *Citrus Fertiliser Trials.*—Owing to the decision of the management of the British South Africa Company's Citrus Estates at Mazoe and Umtali to uproot their Washington Navel trees in the groves in which these trials were being conducted, the latter have perforce come to an end. Over the eight years during which the experiment has been conducted, the complete fertiliser with nitrogen, phosphate and potash have given the best average yield. The results for 1931 show phosphate and potash without nitrogen as giving the highest yield in lbs. of fruit per tree—an average of 400 lbs. per tree, but taken over the eight years this treatment has given an average of 212 lbs. per tree against 224 lbs. per tree from the complete fertiliser.

RESEARCH INTO THE IMPROVEMENT OF NATURAL PASTURES.

Pasture Research Station, Matopos.—Details of the plan of research in operation at this station were published in the annual report of this Branch for the year 1930.

In addition to the plan as originally outlined, an experiment is now in operation to determine whether the addition of minerals in the form of a lick will exercise any material influence on the rate of growth and productivity of animals when the grass is not controlled by cutting and the animals are left under ranging conditions. The behaviour of these animals will be correlated with that of the other groups of cattle where the pasture is either controlled by cutting and grazing or by a combination of these two factors with fertilisation of the grass with phosphatic, potassic and nitrogenous fertilisers.

Results so far obtained at Matopos in regard to the grazing animals have been very striking and it has been possible on the small acreage available to carry successfully through the year the whole of the 55 experimental animals

without any supplementary feeding. All of these beasts were in splendid condition at the end of the dry season, and the results show that where hay is cut at the proper season of the year and fed to the grazing animals during the winter months, there is very little loss of weight, and the animals can be maintained in excellent condition throughout the complete year.

The main influence of fertilisation so far has been on the quantity factor of the grazing rather than on the quality factor.

The results of the experiments here have indicated that the major point of importance to farmers in Matabeleland is that if they hope to keep their cattle in good condition without supplementary feeding during the winter months, they would be well advised to make every effort to carry out their hay-making during the latter part of January and the month of February. By this process the value of the veld for stock rearing purposes is greatly enhanced.

The results from the grazing animals show a close correlation with those obtained by chemical analysis, and it would appear that this latter method is a valuable guide to the methods of control which should be adopted in pasture management in this country.

A further interesting point is that chemical analyses show that veld which has not been cut or burned undergoes a great deterioration in its feeding value during the following season.

Pasture Research Station, Marandellas.—The experiments at this station have now been in progress for one year, and although it is too early to make any very definite statements regarding the results which may ultimately be obtained, the evidence indicates that control with the mowing machine is of great importance on veld of this nature, and by this means alone an enormous improvement can be made to the carrying capacity of the veld.

As at Matopos, the main influence of fertilisation appears to be on the quantity factor rather than on the quality factor, but it could, of course, scarcely be expected that fertilisation would make any very great difference in one year. Although the carrying capacity of this station was estimated at one

beast to 20 acres, it has been shown that by means of stumping and controlling the grass by cutting and grazing, one beast to 9 acres can very easily be carried without any fertiliser being applied to the veld. Where the grass was not controlled by cutting and stumping, it was found to be impossible to maintain a beast to 9 acres, and the animals subjected to grazing under these latter conditions lost weight materially before the dry season had advanced very far, and their condition at the end of August was so bad that supplementary feeding became necessary in order to keep them alive.

As the results obtained by cutting and grazing had been so successful on this station with cattle, the experiment is now being conducted with pure-bred Merino sheep.

Considerable interest by the general farming community has been manifested in this station. Three Farmers' Days were held throughout the year, in June, August and September. These were very well attended, some farmers coming from long distances. Explanatory addresses were given by the Chief Chemist, the Director of Veterinary Research and the Senior Botanist, the party subsequently proceeding to the various paddocks where the progress and practical results of the experiment were demonstrated by the officers in charge to extremely appreciative assemblies.

CHEMIST'S REPORT.

Matopos Pasture Station.—During the year 72 grass samples from this station have been analysed, 51 of these being from the sandveld area and 21 from the black land. It was noticed that the feeding value of the grass on the sandveld diminished earlier in the growing season than that of the grass on the black land. Regular two-monthly cutting maintained the feeding value in both areas throughout the growing period. The hay from the sandveld area, although good, was of less value than that from the black land. Two cuttings of hay were made on the black land area, the first at the end of January and the second three months later. The analyses of these samples showed the first cutting to have a high feeding value both in protein and minerals. In the second cutting the protein content was maintained, but there was a large drop in the mineral content. Analyses

have not revealed any significant differences in the quality of the pastures from fertilised and unfertilised paddocks.

Marandellas Pasture Station.—Fifty-three grass samples have been analysed from this station, and the results of analysis have in a large measure confirmed the findings on the sandveld area of the Matopos station. The hay, cut a month later, appeared to have a higher feeding value than that from the Matopos sandveld. Samples taken monthly from unstumped and unfertilised land showed a marked deterioration from March onwards, readily accounting for the loss in condition of cattle even when the quantity of pasture is more than sufficient.

In addition to the grass samples, the complete chemical and mechanical analyses of five samples representative of the soil on the station were carried out. These analyses showed that the soils were markedly deficient in the essential plant foods, and consisted of almost 90 per cent. coarse and fine sand.

BOTANICAL REPORT.

Matopos Black Land.—In February the quadrats in each paddock, which had been fertilised but not grazed or cut, were analysed for the second time and the results accurately charted.

The grasses of this black land area are practically all of the better type where food values are concerned. The analyses show, during the year, an increase of 258 per cent. of the "Turf grass" *Ischæmum glaucostachyum*, and 71 per cent. of "Milanji grass" *Digitaria milanjiana*. These are the dominant grasses of the pastures, and both spread by underground stolons and both are valuable fodder grasses.

After the analyses, these quadrats were thrown open to receive the same treatment as the rest of the paddocks, and two other quadrats in each paddock that had been grazed or cut with the rest of the area were enclosed and an analyses of these will be taken next February.

In this way we shall note the effect on the botanical composition of fertilising alone, and of fertilising plus grazing or cutting.

Detailed observations were made in February, September and November. This year it is intended to make these observations more frequently.

Up to the present (this is only the second year of the experiment) the most important result, from the botanical point of view, seems to be that the grasses in the fertilised areas commence their growth earlier than those in the unfertilised areas.

Marandellas.—In January four quadrats were laid down in seven paddocks; two in each were charted accurately, two roughly.

The pastures were visited again and observations made in August and November.

This is the first year of the experiment, and the only result that can be noted is the extraordinarily marked difference between the unstumped and the stumped controls. In the former the grass was so sparse that the stock could not exist on it without additional food, while the latter showed a luxurious pasture on which the stock thrived.

TRAVELLING.

Owing to the extreme necessity for economy, very few journeys to meetings of Farmers' Associations for lecturing purposes could be made this year. In all, four lectures were delivered, at Shamva, Glendale, Umvukwes and Umboe, and opportunity was taken of visiting farms in the respective districts and rendering advice where requested.

Four lectures on soils, manures and dip-testing were given to the pupils at the Salisbury Tobacco Experiment Station.

The Chief Chemist accompanied the Director of Agriculture in November on a visit to the Rhodes Inyanga Estate, and a joint report was submitted as to the possibility of applying to this estate the results obtained on the Pasture Research Stations.

Members of the staff were in attendance at the Salisbury Agricultural Show on 26th and 27th August, in order to explain the exhibit of the Branch and give general advice.

TWENTY-ONE YEARS OF PLANT INTRODUCTION AND TRIAL IN SOUTHERN RHODESIA.

PART II.

(Concluded.)

By H. G. MUNDY, Dip.Agric. (Wye), F.L.S.,
Chief, Division of Plant Industry.

ROOT AND OTHER SUCCULENT CROPS.

BEET, SUGAR (*Beta vulgaris*, var. *saccharatum*).—Succeeds as an autumn-sown crop under irrigation or on moist vlei land, but is not dependable as a summer crop unless aided by irrigation. Requires an exceptionally fertile soil, or one very heavily manured, in order to yield well.

CATTLE CABBAGE (*Brassica oleracea*, var.).—Grows well as an autumn-planted crop on wet vlei land or under irrigation, but is unreliable in summer owing to the inevitable attack of several insect pests, reference to which will be found under the paragraph dealing with kale. Requires generously manured land and is a costly crop to produce.

CATTLE RADISH (*Raphanus sativus*, var.).—Given adequate moisture and freedom from pests, this crop grows well at all seasons of the year and seeds freely, but during the summer months it is very prone to attack by one or more of the insect pests of the *Cruciferæ*. Like the garden radish, if overgrown or under adverse conditions the root quickly becomes hollow and fibrous, and in summer this usually happens immediately a drought occurs or when the rains cease. It is of little value, therefore, for late autumn or winter feed, except where irrigation can be provided, but may possibly find a place as a root crop for sheep in areas where some rain accompanied by heavy winter mists at that season of the year can be expected.

CASSAVA (*Manihot aipi* and *M. utilissima*).—Climatic conditions over the high veld of Southern Rhodesia are insufficiently tropical for these plants to yield well. At altitudes of 4,000 feet and over the crop is slow to mature, and the yield of roots from a two-year crop is no greater than would usually be obtained from sweet potatoes in six to eight months' growth. Well suited to altitudes of less than 4,000 feet and, owing to drought hardiness, particularly so where the rainfall is somewhat unreliable.

CHARD, SWISS. Silver or Seakale Beet. (*Beta vulgaris*, var.).—Not usually a successful summer crop in Rhodesia. Sometimes grown under irrigation by poultry-keepers to provide winter green feed. But for general stock feed purposes there are many more valuable crops which can be grown when irrigation is available.

CHOU MOELLIER (*Brassica oleracea*, var.).—A plant of the kale family. The same remarks apply as to thousand-head kale.

CHICKORY (*Chicorium intybus*).—Has not proved successful as a dry land pasture plant and is intolerant of wet, swampy soils. If the demand warranted it, chickory could be grown with ease and certainty on deep loamy soils as a rainy season crop for the production of the root.

CHINESE CABBAGE (*Brassica oleracea*, var. *chinensis*).—This plant possesses very similar growth characteristics to other types of cabbage, and is liable to attack by the same insect pests. Hindrances to cultivation as a field crop are similar to those in respect to cattle cabbage. Can be grown as a garden vegetable.

JERUSALEM ARTICHOKE (*Helianthus tuberosus*).—Grows exceedingly well during the warm months of the year and yields heavily. No means have yet been found of keeping the tubers, either in the ground or out of it, from one rainy season to another, though perhaps the planting of an intermediate spring crop under irrigation might overcome the difficulty. The need to import seed tubers each year has caused the cultivation of this crop to be restricted to that of a garden vegetable, for which purpose, however, it is deservedly popular.

KALE, THOUSAND-HEAD, ETC. (*Brassica oleracea*).—Also turnip, rape, swedes, kohl-rabi and mustard. None of these can be grown on a field scale in summer owing to attacks of turnip saw-fly, diamond-backed moth, webb worm, the larger cabbage moth and cabbage aphis. During the summer they are sooner or later invariably defoliated and partially or completely destroyed by one or more of these insects. All are successful in winter under irrigation or on moisture-retaining soils, but are not yet extensively grown. They will no doubt in time become more popular winter crops, especially as sheep farming develops, but other succulents such as pumpkins, cattle melons, edible canna and sweet potatoes in summer, and oats and barley for grazing or green fodder in winter, can be produced more cheaply.

MANGEL, MANGOLD WURZEL (*Beta vulgaris*).—There is no known part of the Colony in which the rainfall is of sufficient amplitude and certainty to justify the growing of this crop without the aid of irrigation. The same remarks apply in general to its cultivation as to that of sugar beet. Other succulents grown in summer for use in winter, such as silage, sweet potatoes, edible canna, melons and so forth, can be produced more cheaply and with greater certaintly.

Given irrigation and a highly fertile soil, heavy yields can be obtained from seed sown *in situ* or transplants put out in March.

POTATOES, IRISH (*Solanum tuberosum*).—A large range of late, mid-season and early varieties have received trial. "Up-to-date" has consistently proved the most reliable yielder and the potato best suited to the Colony in general. Mid-season and early varieties—particularly the latter—are usually disappointing in yield and "run out" very rapidly, due, it appears, to greater susceptability to virus diseases. Locally conducted experiments have shown that this tendency can be much reduced by rigid selection in the field, but the expense and labour involved thereby is considerable.

YAM (*Dioscorea*, sp.).—The rainfall of Southern Rhodesia is too light and irregular and the climate is insufficiently tropical to meet the requirements of this crop.

CROPS OF THE GRASS FAMILY.

ADLAY (*Coix Lachryma-Jobi*).—A coarse, strong-stooling annual grass crop cultivated in India, China, Japan and the Asiatic tropics. The type of adlay introduced here was drawn from the Philippine Islands, where it was reported to produce a grain of high feeding value which could satisfactorily be employed as a substitute for wheat or for blending with wheaten flour. The plant proved highly sensitive to low temperatures and even at the lower altitudes was unable to mature a satisfactory yield of grain. Under more tropical conditions adlay might well possess special merit as a silage crop.

BROOM CORN (*Sorghum bicolor*, var. *technicus*).—Has repeatedly been tried as a commercial crop in Rhodesia, but has not become popular, probably due to its extreme susceptability to attack by stalk-borer and aphis. If the price offered for the broom fibre warranted it, the former insect attack, which is the more serious, could be controlled by treatment. Like kaffir corn, the plant appears to thrive best under a somewhat limited rainfall.

BROOM CORN MILLET. Hog millet: Proso. (*Panicum miliaceum*).—The flowering panicle and seed-heads of these millets resemble those of broom corn in general appearance, but the plant does not exceed 1½-3 feet in height. A quick maturing crop, but of little economic importance where more heavily yielding grain and fodder crops can be grown.

COWCANE (*Saccharum* sp.).—Also Indian cane. These two coarse fodders, which were introduced from India, are intermediate between sugar cane and Napier grass (elephant grass) in appearance and growth. As dry land crops, they are less hardy and vigorous than Napier grass, though more tolerant of drought and cold than sugar cane. Under irrigation they are less valuable fodder crops than Uba cane, but are more suitable for silage than Napier grass owing to their more succulent and less fibrous stalks. Their saccharine content compares unfavourably with that of Uba sugar cane.

JAPANESE MILLET. Japanese barnyard millet. (*Echinochloa frumentacea*).—Another of the many types of millet grown primarily as fodder or hay crops. Sensitive to

frost. Revels in a cool, damp soil and grows well on the sand vleis of Rhodesia, which do not become excessively swampy. A useful summer crop which is not cultivated extensively at present, but which will eventually become more popular on the type of soil indicated.

KAFFIR CORN. Milo maize, Sorghum Jerusalem corn etc. (*Sorghum* spp.).—Cultivated to a considerable extent by the natives of Rhodesia, particularly in the dryer areas, but has never become popularised as a European crop on account of the superior attractions of maize. Is much attacked by stalk-borer and aphis, and the grain yield, which is usually less than that of maize, is still further reduced by the depredations of small birds. Saccharine varieties of sorghum suffer from similar disadvantages. Some varieties have proved excellent trap trops for the suppression of witch weed (*Striga lutea*).

KIKUYU GRASS (*Pennisetum clandestinum*).—This well known grass, which originated from Kenya Colony, proves to be rather exacting in its requirements in Rhodesia. It is not satisfactory as a dry land pasture except in areas of high rainfall and winter mists or on pockets of land where exceptional fertility is combined with a cool, moist but well-drained land. It thrives best on deep peaty soils, and is not generally successful on the wet granite vleis of the Colony unless liberally assisted by heavy applications of complete fertiliser. It invariably demands a soil of high fertility, and under irrigation combines well with white clover.

PEARL MILLET. Bulrush millet or babala grass. (*Pennisetum spicatum*).—The plant sometimes known by the name of babala grass in the Union of South Africa is in no way distinct from the widely distributed native grain crop *Munga* or *N'youte*. It is not usually grown by European farmers, but may be worth the attention of poultry keepers who wish to produce their own supplies of this grain. Appears to thrive best on light sandy or alluvial soils and under such conditions possesses some merit as a silage or roughage crop.

SUGAR CANE (*Saccharum officinarum*).—The climate of the high and middle veld of the Colony is too cold and dry for this crop. An exception is to be found in the black,

basaltic vlei soils of the Wankie district where, unaided by irrigation, Uba cane grows extremely well. As an irrigated crop, good development is made at altitudes below 4,000 feet. Is intolerant of cold, ill-drained soils and cannot generally be recommended even as a fodder crop under dryland conditions.

TEFF GRASS (*Eragrostis tef.*).—This annual hay grass so popular in South Africa appears less at home in Rhodesia. It thrives best on sandy and loamy soils, but its yield is uncertain. If sown early it often matures when weather conditions render hay-making almost impossible, while if sown late it frequently suffers from insufficient rain. Yields seldom exceed one-half to three-quarters of a ton per acre. The crop does not appear likely to become one of importance, and is usually only grown on a small scale when a little very choice hay is required for some particular purpose.

TEOSINTE (*Euchlæna mexicana*).—A much-stooling, coarse annual grass, native of Central America. The Rhodesian climate is generally insufficiently tropical for its requirements, and growth is slow. It seldom flowers or seeds, and produces a smaller tonnage of fodder than maize, Guinea grass, Napier grass and several other similar fodders. There is no record of teosinte ever having been grown in Southern Rhodesia with any appreciable success.

MISCELLANEOUS HERBAGE PLANTS.

BASSIA HYSSOPIFOLIA.—A recently introduced herbage plant, native of alkaline soils in California. In preliminary experiments it has grown well and seeded freely, and will be afforded further extended trial.

CHILIAN GOOSEFOOT (*Chenopodium quinoa*).—An annual herb of Chile, Peru and New Granada reputed to possess merit as a herbage plant. Two separate introductions of this species have been made, but in neither case did soil and climatic conditions appear congenial.

KARROO BUSH (*Pentzia virgata*).—This arid country browse plant does not find conditions in Rhodesia to its liking, and its growth is insufficient to render it of economic importance here. Flowers freely and attains a height of six

to nine inches, but does not maintain its place by seeding, and gradually dies out.

LIPPIA REPENS.—A reputed lawn plant from California said to thrive under the shade of trees and recommended for checking sheet erosion. Grows moderately well, attaining a height of four to six inches, but is unable to survive the long rainless winter unless aided by frequent irrigation. Not regarded as of any local value.

SALT BUSH (*Atriplex*, spp.).—All the well recognised varieties of this plant have been tested, included Old Man (*A. nummularia*) and Creeping Salt Bush (*A. semibaccata*). These desert and alkaline-loving plants are not at home under the more humid conditions and on the acid soils of Rhodesia, and generally speaking do not appear to justify cultivation. The two varieties specifically named above show more promise than any others, but a large acreage under either would be required to yield any considerable amount of fodder.

SHEEP'S BURNET (*Sanguisorba minor*).—A low-growing herbage plant of Europe, sometimes recommended as a pasture plant for poor, dry soils. Is unable to withstand the long, dry winters of Rhodesia, and is intolerant of swampy soils. Is of insufficient merit as a grazing plant to warrant its being grown on irrigated land.

SHEEP'S PARSLEY (*Carum petroselinum*).—The same remarks apply as to sheep's burnet.

SHEEP'S TANSY (*Phacelia tanacetifolia*).—An annual herbage plant from California. Grew well in spring under irrigation, but has failed in summer and makes little growth in winter. Cannot apparently subsist unless aided by irrigation.

MANA-TO-KO (*Myoporum insulare*).—A succulent plant introduced from the Eastern Province of Cape Colony. Reputed to possess value as a fodder plant and to be suitable as a hedge. Has failed to survive the winter, except when assisted by irrigation, and does not apparently justify cultivation under such conditions.

FIBRE CROPS.

AHCAN (*Ananas macrodontis*).—A number of plants were received for trial through the assistance of the Royal Botanical Gardens, Kew. These were propagated for several years, some in pots filled with specially prepared compost, and some in the open ground. They made no growth, and in spite of being watered when it appeared necessary, and being afforded protection from cold winds and frost in winter, they all finally died. Climatic conditions were apparently unsuitable, temperatures probably being too low.

BROTEX (*Lavertera arborea*).—A plant much advertised a few years ago as producing an admirable fibre, a seed crop suitable for conversion into cattle-feeding cake and a suitable pulp for paper manufacture. Plants only grew to a height of two to three feet and failed to survive the winter, although watered when it seemed necessary.

FLAX: LINSEED (*Linum usitatissimum*).—Many strains of this crop, including "J.W.S.," bred by the Irish Linen Research Institution, have been experimented with, and a certain amount of selective breeding has been undertaken. The periodical spells of extremely hot and dry weather, which are always liable to occur during the Rhodesian summer, appear to render conditions unsuitable for the growing of flax as a rainy season crop.

It thrives better in winter under irrigation in the warmer areas not liable to severe frosts. Even under the most favourable conditions the grain yield is light and seldom exceeds eight to ten bushels per acre. Production is limited to the Colony's requirements of linseed.

FLAX: NEW ZEALAND (*Phormium tenax*).—This well known perennial fibre plant grows well when irrigation can be provided or given an adequate supply of moisture during the dry season. It shows considerable promise on partially drained wet vleis in the granite, sand-veld areas of the Colony, and may well have commercial possibilities.

HEMP, BIMLAPATAM (*Hibiscus cannabinus*).—A common and troublesome weed plant, particularly on sandy, granite soils. Introductions have grown extremely well, and the crop has undoubted commercial possibilities if a satisfactory system of mechanical extraction of the fibre could be

perfected. *H. sabdariffa* also grows freely with less tendency to branch, but does not seed so heavily. Local selection of desirable plants has proved the feasibility of developing strains of both species markedly free of the branching habit.

HEMP, BOWSTRING (*Sansevieria sulcata*).—This, together with *S. cylindrica* and other allied species, occurs naturally in scattered clumps under the shade of trees and bushes in the hotter and dryer districts of the Colony. The wild plants do not occur in sufficient quantity in any one locality to warrant their presence being regarded as an economic asset, and from trials which have been made it is not considered that any of the species would justify treatment as a cultivated crop.

HEMP, COMMON (*Cannabis sativa*).—Has been introduced and re-tested several times, but in no instance have the plants made satisfactory growth. The same remarks apply to Kentucky hemp seed introduced from the United States of America.

HEMP, MAURITIUS (*Furcroya gigantea*).—Grows extremely freely and attains great length and width of leaf. Could be cultivated very extensively if the commercial aspect justified it.

HEMP, SISAL (*Agavi sisalana*).—Does not grow as freely or luxuriantly as Mauritius hemp, and in most parts of the Colony the leaf development appears inadequate to warrant commercial production. Shows better promise in the warmer parts of the Mazoe and Gwelo districts, and if prices for the fibre improve, may ultimately find a place among the commercial crops of some of the warmer areas.

JUTE (*Corchorus olitorius*).—No success has attended any introductions of this crop.

RAMIE, SILVERY. China grass. (*Bœhmeria nivea*).—This admirable fibre plant grows freely as a perennial, dry-land crop, and even better under irrigation. Difficulties in connection with the extraction of the fibre render its cultivation at present uneconomical. Similar remarks apply in the case of *Urena lobata*.

SIDA, spp. (*Sida rhombifolia*).—This species, together with *S. longipes*, *S. cordifolia* and *S. acuta*, are not uncommon

under-shrubs in many parts of the Colony. The first-named in particular is said to yield a fibre of very high quality, but difficulty and cost of extraction appear an almost insuperable obstacle to development of an industry from this crop. Grown readily from seed.

The young shoots are browsed by cattle and sheep in early spring, but value in this direction does not warrant cultivation.

TREE COTTON (*Gossypium arboreum*).—A perennial bush or small tree. Much attacked by all the insect pests of cotton present in Rhodesia and therefore a dangerous host plant for carrying over these pests from one year to another. Produces its fruit during the period of heaviest rains, which leads to much injury to the lint. Apparently without merit as a commercial crop.

OIL SEEDS AND ESSENTIAL OIL PLANTS.

CASTOR OIL (*Ricinus communis*).—Numerous strains of this crop have been introduced, and it has been grown experimentally by a number of farmers. Individual plants, especially "escapes" growing on waste land, bear profusely, but when brought under cultivation as a field crop the yield of beans has always proved too light to afford a profitable return to the European farmer.

NIGER SEED (*Guizotea abyssinica*).—The seed yield of this annual crop is too low in Rhodesia to warrant its cultivation for purposes of oil production. Some years ago it gained considerable popularity as a green manure crop, but of late has almost entirely been superseded for this purpose by sunflower, sunn hemp and various other legumes. It none the less possesses distinct merit as a green manure plant and can also be converted into an excellent and palatable silage of high feeding value.

PERILLA (*Perilla ocymoides*).—This plant was introduced through the agency of the Imperial Institute. It grows moderately well in Rhodesia, but the seed yield is too low to render the crop profitable for cultivation by Europeans.

PEPPERMINT (*Mentha piperita*), also *M. piperita vulgaris* and *officinalis*.—Grows freely on heavy, dark soils

under irrigation, but if not irrigated fails to survive the dry season. May have commercial possibilities.

SPEARMINT (*Mentha viridis*).—The same remarks apply to this species. Is not used for the production of commercial "peppermint oil," but the leaves are employed for flavouring foods and drinks.

SESAMUM (*Sesamum orientale*).—This crop was at one time grown quite extensively by the natives of Mashonaland, but is now more rarely seen. Both native and introduced strains have been tested exhaustively, but the seed yield is very light, and without considerable improvement in this direction the crop cannot be recommended for cultivation by Europeans. As maturity approaches, the capsules open and seed is shed very readily, a factor which adds to the difficulty and expense of harvesting.

TARWEED (*Madia sativa*).—No success has attended the several introductions of this plant.

DYE PLANTS, SPICES AND CONDIMENTS.

ANISEED (*Pimpinella anisum*).—Grows well and seeds freely as a summer crop under normal rainfall. Might be cultivated extensively if markets justified.

ANNATTO (*Bixia orellana*).—A large perennial bush with attractive flowers and foliage. Grows well and seeds fairly freely; could be cultivated commercially if the demand warranted. Is leafless in mid-winter but makes an ornamental garden shrub.

CORIANDER (*Coriandrum sativum*).—The remarks made in connection with aniseed apply to this crop also.

LIQUORICE (*Glycyrhiza glabra*).—Will not survive the winter if grown as a dryland crop, but provided a market can be found for the product, is deserving of further trial under irrigation, particularly at lower altitudes.

SAFFLOWER (*Carthamus tinctorius*).—This rather handsome annual grows quite freely as a summer rainfall crop, but has not yielded seed as heavily as sunflower. Is very hardy and might be grown extensively as a dye or oil seed plant if prices were sufficiently attractive.

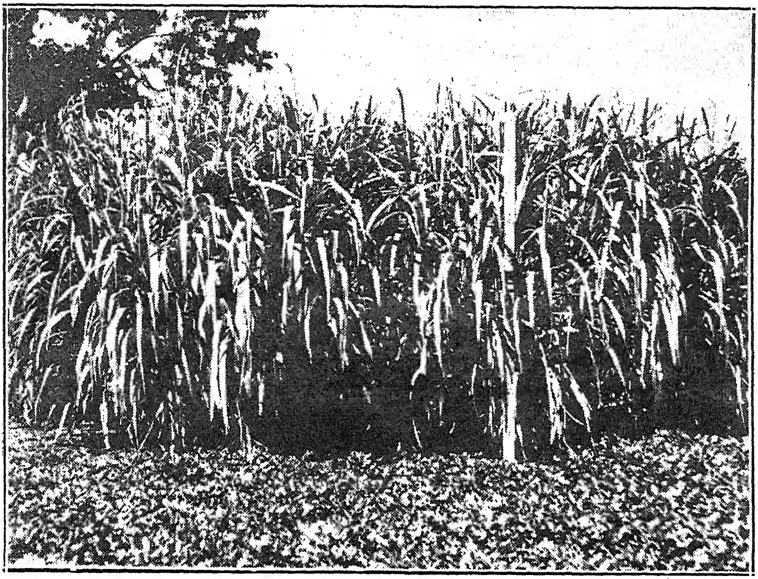


Fig. 1. Cow-cane, mature growth.

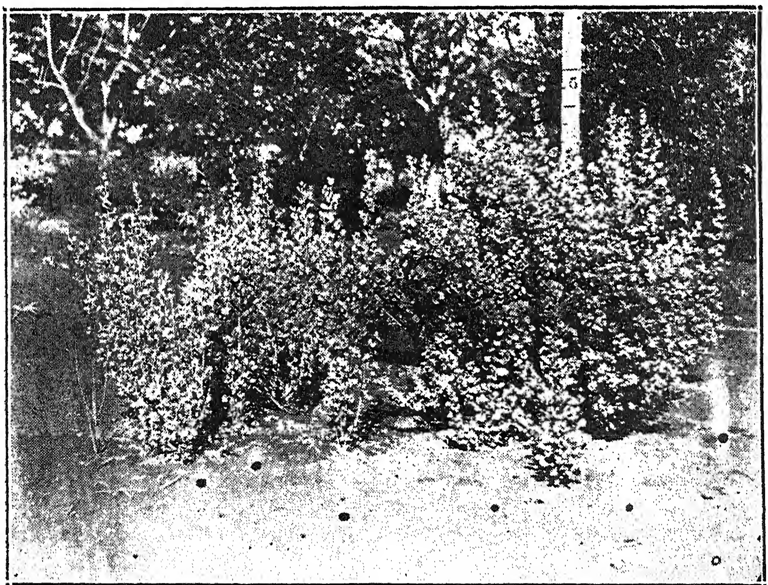


Fig. 2. Old-man Saltbush. The oldest plant is three years old.

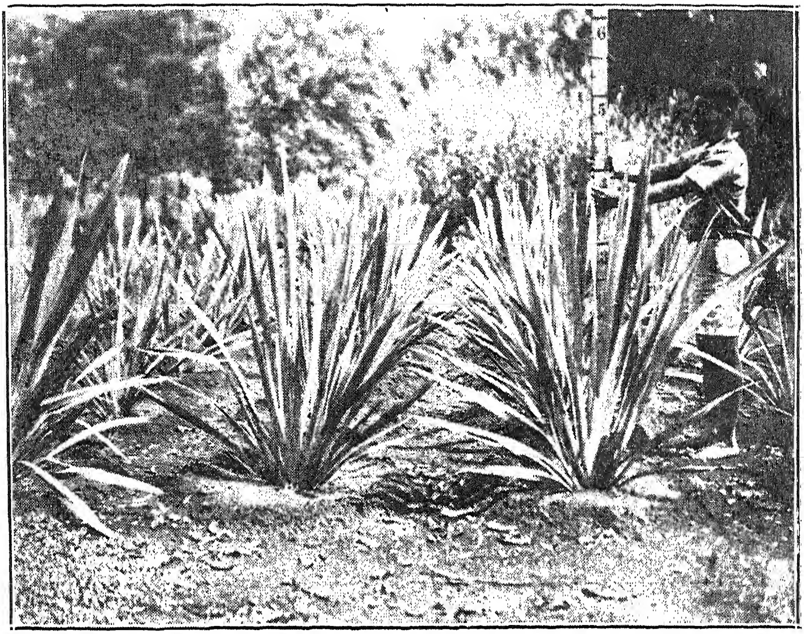


Fig. 3. New Zealand Flax, three years' growth on red soil, watered periodically during the dry season.

Fig. 4. Arrowroot growing on the Salisbury Experiment Station.

SAFFRON (*Crocus sativus*).—No success has attended introductions of this crop.

TURMERIC (*Curcuma longa*).—This plant subsists from year to year and does not die out. It appears above ground with the advent of each rainy season, but produces practically no growth or development. Climatic conditions appear altogether unsuitable.

SUNDRY OTHER PLANTS.

ALGAROBILLA (*Cæsalpinia brevifolia*).—A small shrub native to Chile, the pods of which are an important source of tanning material. Makes moderate growth in winter, but succumbed in summer. Climatic conditions are apparently unsuitable.

ARROWROOT (*Maranta arundinacea*).—Grows moderately well as an irrigated crop at the lower altitudes, and given such conditions, is deserving of further trial. It appears entirely unsuited as a dryland crop, except, possibly, for areas of high temperature and precipitation above the normal.

ACTINIDIA CHINENSIS.—A scandent vine-like plant introduced from California and said to produce a fruit of very attractive flavour. Grows moderately well in summer but does not fruit in Salisbury at an altitude of 4,800 feet. May be worth further trial under irrigation at lower altitudes.

CANAIGRE (*Rumex hymenosepalus*).—This plant of the "Dock" family, which provides a source of tannin, has not succeeded as a dryland crop, but grows moderately well under irrigation. Much difficulty, however, has been experienced in obtaining a satisfactory germination of seed and a good stand of plants. Might be worth attention if prices and demand were sufficiently dependable.

CHERRY, PITANGA (*Eugenia uniflora*), also *Eugenia hookerii*.—Grow into small, shapely trees of fifteen to thirty feet in height but do not fruit sufficiently to be of value on this account.

CHIVES, GIANT (*Allium schoenosprasum*).— Can be grown as a winter crop under irrigation but not as a dryland summer crop.

GOOSEBERRY (*Grossularia echinella*).—This is the species of gooseberry which in its wild state is reported to occur furthest south on the American continent. For this reason it was introduced into Rhodesia, where the ordinary types of gooseberry grown in Europe have not yet been found to thrive. The entire plant, including the berries, is densely covered with spines, which exude an unpleasantly flavoured juice. Several plants have grown and fruited freely on the Salisbury Experiment Station, and it may be that this species can be utilised with advantage as a stock on which to bud improved types of commercial gooseberry.

HOP (*Humulus lupulus*).—Several introductions of this crop have been made, and it has been tested both with and without irrigation on the high veld at an altitude of 4,800 feet and at lower elevations down to 3,200 feet. In no case has anything approaching satisfactory growth been made.

HYDNOCARPUS ANTHELMINTICUM.—Medicinal preparations utilised in the treatment of leprosy are obtained from this evergreen tree. It appears to require a certain amount of shade, since it is reported as almost invariably occurring in its native habitat in association with other evergreens. On the Salisbury Station the seeds germinated and the young plants grew for about six months, but then died off. May possibly meet more congenial conditions in the cooler and moister climate of the Eastern Border.

PHYSIC NUT (*Curcas purgans*).—A small tree which grows well and bears heavily in all parts of Mashonaland. Young plants volunteer freely from self-sown seed. There appears, however, to be no market for the seeds, which may be utilised for medicinal purposes and which also contain a high percentage of oil.

POPPY, OPIUM (*Papaver sativum*).—Could be grown as a winter crop aided by irrigation. Poppies do not thrive in Rhodesia during the rainy season.

SUNBERRY (*Physalis minima*).—A solanaceous plant of the Cape gooseberry family which produces a small purple-coloured berry. Is now a naturalised weed throughout the Union and Rhodesia. May be utilised for jam-making, but is not equal in yield or economic importance to the Cape gooseberry (*P. peruviana*) or giant austral berry (*P. ixocarpa*).

TRIGONELLA FOENUM GRAECUM.—An annual herb, the seeds of which are used in veterinary medicine. Has made no satisfactory growth or development in any trial so far conducted.

WORMWOOD (*Artemisia*, spp.).—Utilised in the preparation of vermifuges and for other medicinal purposes. Subsists unthriftily as a summer crop unaided by irrigation. Might perhaps be produced commercially in some districts with the aid of irrigation if an adequate market were available for the product.

Acknowledgment is made of assistance rendered in the compilation of this list by Mr. H. C. Arnold, manager of the Salisbury Agricultural Experiment Station, under whose supervision all recent introduction trials have been made; to Miss S. M. Stent, Senior Botanist; and to Mr. J. A. T. Walters, late Assistant Agriculturist in this Department, who was in charge of the work during the years 1914-1918, *and who in June,* 1916, *published an article in this Journal entitled "Crops Unsuitable to Southern Rhodesian Conditions," and who has kindly checked the present record.*

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

REPORT OF THE COTTON SPECIALIST, EMPIRE COTTON GROWING CORPORATION,

FOR THE YEAR 1931.

Season.—Taking into consideration the main cotton growing areas, the season varied from very severe drought conditions in the Hartley district to moderate drought conditions in parts of Mazoe and Lomagundi. The actual rainfall would have been sufficient for the cotton crop, but the distribution generally was bad. Long drought periods occurred in February and March, which caused much shedding of young buds and flowers. In certain parts of Matabeleland the drought was even more severe, yet the cotton crops there weathered the conditions moderately well, due, probably, to the better moisture retaining capabilities of the sandstone formation, particularly in the Umgusu Valley.

Towards the end of the season minimum temperatures were slightly higher than usual, and it is presumed that this enhanced the quality of the lint, a feature of the season to which further reference will be made.

Acreage, Yield per Acre, and Total Production.—It was reckoned that there would be about a 50 per cent. increase in acreage over that of the previous season, but actual figures obtained through the courtesy of the Government Statistician show the acreage to be slightly less than was anticipated. The provisional figures given for the cotton crop, 1930-31 (received 31st December, 1931), are as follows:—

Cotton Crop, 1930-31 (*Provisional Figures*).

	Cotton		Cotton Ratooned		Total Cotton	
	Acres	Yield (lbs.)	Acres	Yield (lbs.)	Acres	Yield (lbs.)
Returns received	7,009	2,151,235	359	84,912	7,368	2,236,147
Returns outstanding ...	1,535	443,100	125	29,750	1,660	472,850
Grand Total	8,544	2,594,335	484	114,662	9,028	2,708,997

From the above table, it will be seen that the total area of 9,028 acres yielded 2,708,997 lbs. of seed cotton, an average of 300 lbs. seed cotton per acre.

The above total is slightly greater than the total amount of seed cotton delivered to the ginneries, which figure is given as 2,365,770 lbs. The difference may be due to the fact that not many farmers have the means of correctly weighing their seed cotton in the woolpacks, in addition to which a certain proportion of low grade cotton is usually kept back, as it is difficult to sell at the present time; its value may not cover cost of ginning, rail and ocean freight.

Reckoning the total yield in Empire bales of 400 lbs., we get a figure of 1,974 bales, which comes within 26 bales of the 2,000 bale estimate.

Average Yields per Acre Obtained from 1923-24 *to* 1930-31.

Season	Acreage Planted	Average Yield per Acre of Seed Cotton
1923-24	3,947	428
1924-25	62,858	93
1925-26	66,086	124
1926-27	8,134	90
1927-28	1,340	85
1927-28	(U. 4 cotton seed increased from 15 lbs. to 2,000 lbs. on Cotton Breeding Station.)	
1928-29	(Above ton of seed increased by farmers to 66 tons.)	
1929-30	6,134	289
1930-31	9,028	300

From the above table, it would appear that a slight increase in the yield per acre was obtained, but it is doubtful if the increase is really significant. Taking into account, however, the severity of the drought conditions which prevailed in the Hartley district, and which must have tended to lower the average, the yields are well above the average of the previous seven years. This satisfactory state of affairs may safely be attributed to the fact that only the U. 4 variety of cotton seed is now grown in Southern Rhodesia, and that the closer spacing in the row, combined with the use of a heavier seed rate, is having the desired effect of increasing the yield per acre.

Quality.—The remarks made in previous reports concerning the lack of "character" in cotton from Southern Rhodesia, are not applicable to the cotton produced in the year under review, when a very distinct improvement was noticeable.

Mr. T. G. Hesse, Manager of the Central Co-operative Cotton Exchange, Limited, Durban, writing on 30th October, 1931, in the Rhodesia Supplement to his "Market Notes," stated:—

> "The character of the cotton marked a distinct advance on previous seasons, and the crop has been the best we have yet handled from Rhodesia."
>
> "The evenness of grade and staple was particularly marked. Our Liverpool connections, shortly after receipt of our first shipment, cabled us repeat orders—a compliment which had not previously been paid."

In this connection it may be permissible and necessary to repeat the remarks which I made under this same heading a year ago:—

> "It is not suggested that improvement in the 'character' of Southern Rhodesian cotton will take place suddenly, but steady progress is being made towards obtaining this desirable character. In the event of a favourable growing season, however, we may find a sudden improvement which, should it occur, must not be taken to mean that the difficulty under discussion has been finally overcome."

As mentioned before, it is suggested that the slightly higher minimum temperature towards the end of the season may have had much to do with the improvement in character.

Ginning.—Four ginneries operated throughout the ginning season. These were:—The Bindura and District Co-operative Ginnery, Limited, the Central Cotton Ginneries, Limited, the Hartley District Ginnery, Limited, and the Street Cotton Ginnery. The average ginning percentage varied from 33.1 per cent. to 34 per cent., while the percentage of waste varied from 1 per cent. to 5.8 per cent. The latter figure appears to be on the high side when one considers that the variation in the percentage waste in three of the ginneries ranged from .9 per cent. to 1.3 per cent.

Classification of Seed Cotton.—Three out of the four ginneries in operation made use of the Seed Cotton Classifier's services. That these services were much appreciated is evidenced by the testimony of the Manager, Central Co-operative Cotton Exchange, Limited, Durban, and the Senior Cotton Grader of the Union of South Africa. The latter, in a communication dated the 9th of October, referring to the work of the co-operative ginneries, stated:—

> "The classification of the seed cotton, mixings, ginning and sampling has, to my mind, been done in a most efficient manner, and has helped with the marketing of the lint considerably."
>
> "The ginneries in question are to be congratulated on the efficient manner in which they have carried out the instructions of the Seed Cotton Classifier, whose timely appointment appears to be fully justified."

Central Co-operative Cotton Exchange, Limited, Durban.—This organisation has again proved its usefulness in effecting prompt sales on behalf of the ginneries in Southern Rhodesia which are affiliated to it. But for the services rendered by the Exchange, it would have been exceedingly difficult, if not impossible, to dispose of the cotton entrusted to them for sale. In addition to the very low prices which prevailed, unforeseen problems arose as a result of the gold standard having to be abandoned by Great Britain, which action was soon followed by Southern Rhodesia. While this has ultimately benefited our cotton growers, the transition period was one in which great care had to be exercised in negotiating sales, and it was a relief to know that these transactions were in the experienced hands of a concern such as the Central Co-operative Cotton Exchange, Limited.

The Manager, Mr. T. G. Hesse, toured the principal cotton growing areas during part of January and March, and had discussions with farmers at various centres.

Cotton Breeding Station, Gatooma.—In addition to the work which has been carried out on the Cotton Breeding Station in former years, a beginning was made with extension work whereby records were collected from other districts. This necessitated the creation of sub-recording centres on

farms where plots were laid down by several progressive cotton growers, who willingly co-operated with the staff of the Cotton Station at Gatooma.

Records on the sub-stations were taken by native recorders, who had been trained at Gatooma. When initiating this line of work, it was not known what degree of reliance could be placed on records so taken, but it is satisfactory to state that these exceeded expectations on three out of the four sub-stations where the native recorders were placed. Useful information regarding seasonal development, responses to cultural practices, behaviour of sub-strains and insect attacks were obtained, and used for comparison with results on the main station at Gatooma.

An attempt was made to breed grain moths at Gatooma for the purpose of rearing *Trichogramma lutea* (a bollworm egg parasite). Owing to lack of proper facilities, however, the attempt was abandoned.

Now that the station is being equipped with better laboratory accommodation, it should be possible to follow up such lines of investigation.

It is reckoned that the February-March droughts did more to reduce yields on the station than did the attacks of the various bollworms.

In comparison to former years, Jassid attack was relatively mild.

Evidence was obtained confirming advice given in the past in matters relating to cultural practices, and the non-application of artificial fertilisers.

The detailed report of the year's work on the Cotton Station was forwarded to the Empire Cotton Growing Corporation, London, on the 17th November, 1931.

United Kingdom Trade Mission.—The writer gave evidence before the United Kingdom Trade Mission under the chairmanship of the Right Honourable Lord Kirkley. Two members of the Mission, Mr. Robert Waddington and Mr. John Morgan, paid a special visit to the Cotton Breeding Station, which they inspected in detail. The Mission's reference to cotton growing in Southern Rhodesia may be found on page 52 of the report which they subsequently issued.

Prospects for Current Season.—At the time of writing it is not possible to hazard even a guess as to how much cotton has been planted this season. Owing to the extremely low prices at which last season's crop was sold, there was little inducement to farmers to plant any cotton at all. Nevertheless, many have done so, but on a more moderate scale than last year. On the other hand, it is anticipated that for this year there will be a considerable increase in the acreage of ratooned cotton. How far this practice will prove to be successful, or otherwise, remains to be seen. It is only fair to farmers to state that in general they do not approve of ratooning, but conditions being as they are, it is difficult for them to do otherwise.

In the event of even a moderate recovery in prices, there is reason to hope that the acreage will increase materially next season, as farmers have now regained confidence in their ability to grow cotton. This in itself is a very distinct advance, as it has been difficult to eradicate the bad impression created during the disastrous years of 1925 and 1926. It is safe to say that cotton growing in Southern Rhodesia will readily respond to any general improvement in world economic conditions.

SOIL DRAINAGE AND UTILISATION OF VLEIS.

By R. H. Roberts, B.Sc.(Eng.), Assistant Irrigation Engineer.

The drainage of vlei lands has been frequently effected in the past by cutting a central channel on a steep slope. While this practice is cheap and very effective in the initial years, it merely results in additional trouble before long, as the channel becomes a "donga" and a great deal of expense is involved in controlling it to avoid the total loss of the valuable soil brought under cultivation. Moreover, it is impossible to control the sub-drainage and re-constitute the vlei-conditions if it is desired to do so in years of low rainfall. It is not generally known, perhaps, that tampering with vleis which are definitely the sources of public streams is prohibited under the "Water Act of 1927."

For these reasons the drainage of vlei lands has never been strongly advocated by this Department, and it is only with the adoption of proper methods of drainage that the reclamation of wet land should be attempted.

There is no doubt that land exists on many farms which is extremely rich and capable of producing heavy yields per acre if it were once freed of its surplus moisture. Moreover, land of this type does not usually occur in large self-contained blocks; most frequently it is found in the form of patches or tongues mixed up with "dry" red soils, so that proper working of the whole area as one is very difficult. A common case, for instance, is that of a tongue of wet soil extending from the edge of an adjacent vlei. In passing, it may be observed that wet patches of this nature are often found to be extending and widening themselves as time goes on, so that it is possible that they are caused by the trampling action of cattle in the wet soil of the adjacent vlei. The

extension in area of the wet land is also due to the higher ground being maintained under cultivation, and thus absorbing more moisture, which gradually percolates down to the low-lying area.

Necessity for Drainage.—A soil consists of an aggregation of a very large number of small particles, which vary greatly in composition, size and shape. Since these particles do not fit snugly together, spaces exist between them, so much so that the volume of voids constitutes approximately 50 per cent. of the total. In a well drained soil each particle is coated with a film of moisture which clings to the particle by force of surface tension. The void spaces are therefore filled with air, which is a vital necessity for the maintenance of plant life. If an excess of moisture is forced on the soil it temporarily fills the voids, but proceeds to gravitate downwards and draws in a fresh supply of air behind it—that is if the soil is properly drained, naturally or artificially; if not, the surplus water merely stagnates and prevents the renewal of the oxygen supply.

A plentiful supply of free oxygen is as indispensable to plant life as to animal life. Oxygen is necessary for the germination of the seed for the propagation of roots, for the soil bacteria which produce nitrogen in its various forms, and for many other processes and chemical changes essential to the fertility of the soil.

Here, then, is an urgent argument for good drainage.

Another effect of under-drainage is to encourage the crops to root themselves deeply. If the permanent ground water stands near the surface of the soil early in the season, the roots are compelled to confine themselves to the upper few inches. If a drought develops later in the season, the water surface falls and the shallow soil in which the roots are confined becomes dry, since capillary action is too slow in supplying the necessary moisture. With proper drainage the early roots are compelled to penetrate more deeply into the soil in search of moisture, so that supplies are more evenly drawn upon and the plant is in a much better position to withstand a dry spell. Moreover, the decay of these roots later leaves additional means of entry for air into the deeper parts of the soil.

Wet lands are "cold" lands, owing partly to the high specific heat of water, which demands a greater quantity of heat to warm it than does an equal weight of soil, and partly to the cooling effect of the high rate of evaporation from a wet surface. The effect of drainage, by lowering the level of the ground-water surface, is to raise the temperature of the soil, particularly in the upper 12 inches, and thereby greatly to improve the conditions for plant development.

The most obvious benefit of drainage is in preventing a heavy soil becoming unworkable through excessive moisture. When properly under-drained, the surplus water is quickly removed, so that the heavy soil may be ploughed and planted at the same time as the adjacent lighter soil.

Causes of Water-logging.—As far as Rhodesia is concerned, three main causes may be recognised:—

(1) Surface water running off from high ground and collecting upon adjacent low-lying flat lands, which are unable to pass it off or absorb it sufficiently rapidly.

(2) Seepage water percolating from the lower strata of high ground on to lower lying areas, and reaching the latter either directly on the surface or by rising from below.

(3) Lands in general which are underlaid at a shallow depth by heavy clay beds, forming an impervious sub-soil.

Since these causes do not always work singly, but more frequently combine to a greater or lesser degree, the diagnosis and cure of the trouble is not usually the simple matter it might appear. There is no doubt, however, that in a great many cases water-logging is to a large extent due to surface water from higher ground collecting and lying on the flat black lands below, and to that extent the treatment is obvious. A system of storm drains and contour ridges should be employed on the high ground to collect and divert the surplus water and prevent it reaching the low-lying lands.

Types of Drain.—The aim and object of all systems of under-drainage is to lower the level of the ground-water by providing it with outlets, properly proportioned as to depth and distance apart, so that surplus water will gravitate into them, and leave no more than a normal moisture content in

the upper layers of soil. The flow of ground-water is resisted by the particles of the soil through which it has to pass. The tighter the soil, the greater the resistance it offers, and the steeper the gradient of the surface of the ground-water. Obviously, the steeper the gradient, the closer must the drains be placed together, if the surface of the ground-water is not to lie at less than a given depth below the surface of the ground.

No hard-and-fast rules can be laid down as yet for Rhodesian conditions, but a general guide may be taken from practice overseas, where good drainage is generally secured in average loose loamy soil with drains 100 feet apart and $3\frac{1}{2}$ feet deep. In heavier soils they would need to be correspondingly closer together, but not necessarily deeper.

Open Drains.—Open drains are the most obvious means of removing surplus water, and in certain circumstances they should and must be used. Apart from their use purely as storm water drains, there are often cases where water seeping down from porous strata of adjacent high ground on to the low-lying land can be intercepted by means of an open drain, which would give a cheap solution of the problem. Again, open drains are necessary to collect and dispose of water led into them by other systems of under-drains.

Open drains, however, suffer from several disadvantages: they are an unmitigated nuisance in ploughed lands and require a certain amount of attention for cleaning. Moreover, they are objectionable, in that they harbour weeds, are liable to damage by cattle, and are a potential means of soil erosion. Some form of covered drain is therefore always preferable for the arable land itself.

French Drains.—The earliest development of the open drain was to fill it in, after providing some device in the bottom of the trench through which the water could readily percolate. Numerous expedients have been adopted, ranging from bundles of brushwood to properly-built stone drains with paved bottoms, and top and sides built of flat stones or brick. Two slender poles are sometimes laid side by side and a third laid on top, the whole being covered with brushwood and soil. With the "white ant" problem in Rhodesia, none of the timbered French drains are likely to prove very

long-lived, and some type of stone drain is to be preferred if stone is reasonably available.

If a drain of this type is to prove a permanent asset, a fair amount of trouble should be taken to lay the stone as closely as possible to prevent fine material silting in and clogging the openings. Good broken brick often makes a substitute for stone. The coarser stone should be placed in the bottom, followed by smaller stone and then a layer of gravel, before refilling the trench. Bricks form a neat channel, but can only be recommended if thoroughly well burnt and carefully selected; the ordinary farm-made brick is not usually a sufficiently durable article. An under-drain, like a chain, is only as strong as its weakest link; one soft brick is enough to clog the whole drain.

The depth of the drain should not be less than 3 feet, and very much better results will be obtained if the depth is made 3 ft. 6 ins. or 4 ft. However, where a definite subsoil of very tight clay exists, there is no point in going more than a foot into it, and the drains will require to be correspondingly closer together. For economy's sake, not only in the excavation but also in the stone filling, the width of the trench at the bottom should be as narrow as possible; twelve inches is ample, but the actual figure will be dictated by the size of the stone that is to be used.

The gradient of the trench will often be controlled by the type of lay-out adopted for the whole system, but should be as steep as possible, since a drain of this description offers a considerable amount of resistance to flow. The gradient should be as uniform as possible, and, while a change from a flat slope to a steeper one is permissible, the reverse should always be avoided, to prevent silt deposits clogging the channel.

The lay-out of a system of French drains depends so much on the peculiarities of each individual case that general rules are not of much value, particularly as, before undertaking such work, it is usually advisable to obtain proper engineering advice. Apart, however, from a whole system of drains, very good work can often be done with a single drain to cure an isolated spot or tongue of wet land, in which case the drain is often placed to advantage on the upper side of

the centre of the wet patch. Strips of wet land as wide as twenty yards can usually be effectively treated by a single French drain.

Tile Drains.—The invention and cheap manufacture of circular tiles revolutionised drainage practice. The water was provided with a uniform, clear channel, a great improvement on the tortuous passage afforded by a French drain. Very little fall was required to carry the water off (as little as 2 ins. in 100 ft.). If the work was carefully done and good material used, the drains were practically everlasting.

Tiles should not be less than 3 ins. in diameter, and are usually best laid at a depth of between 3 and 4 ft. Lesser depths are sometimes used, but in a country of cheap labour it is better economy to dig deeper trenches and space them somewhat further apart so as to reduce the amount of tiles required.

The cost of tiles (£12 per 1,000 ft. two years ago) is at present the chief drawback to their use under Rhodesian conditions.

The distance between the tile-drains will vary from 50 ft. or less in tight soils, up to 200 ft. in looser soils, and the actual disposition of the system of trenches will depend on the local conditions of shape, slope, position of natural channels, etc. The trenches require to be carefully dug to secure an absolutely uniform gradient, without bumps or hollows, which would cause clogging. Accurate levelling is therefore required both before and after the excavation of the trench.

The tiles should be laid as soon as the trench has been dug and smoothly graded. Great care should be taken in laying the tiles to ensure a close fit at the joints. It is essential for permanently satisfactory results that the tiles themselves should be perfectly circular in section, straight and with square ends, so that a minimum of adjustment will be necessary in fitting the tiles closely together. No appreciable space is required at the joints; water will percolate through the closest joint, and if too much space is left it will only result in silt gaining entry to the drain and clogging it up.

When the tiles have been properly laid and inspected, they should be covered with a few inches of soil (free from

stones, which might break the tiles) to prevent movement, and then the mass of earth can be filled back into the trench, either by hand or by some form of scraper.

Where a minor tile drain joins a main line (usually of bigger diameter), it should enter above the centre of the main tile and at an angle of 30 degrees or so. A Y-piece is preferable to a T-piece. The joints at the junction should be made with wet clay. The outfall of a line of tile-drain into a natural channel requires special treatment, and should be walled off with brick or concrete to prevent damage by cattle. The additional precaution is often taken of covering the end with metal gauze to keep out rats and other vermin.

Generally speaking, tile draining, if properly carried out, is very efficient and gives permanent results, but cannot be recommended at present for Rhodesian conditions on account of the expense.

Mole-Draining.—Mole-draining is no new discovery, but it has gained prominence in recent years through improvements in the mole-draining plough and the application of mechanical power.

Mole-draining consists essentially of forming a series of miniature tunnels through the subsoil by means of a hardened steel "cartridge" or "torpedo," attached to the bottom of a sharp, strong, vertical coulter, which projects downwards from the framework of the plough, consisting of a skid (often on wheels).

The application of mole-draining is strictly limited to lands having clay sub-soils, for it is obvious that the tunnels will not be permanent in soils of a loose character. Mole-drains are best placed at a depth of 16 to 18 ins., which is sufficient to get them into firm subsoil and protect them from damage due to ploughing at ordinary depths. Modern practice appears to have crystallised in favour of a mole $2\frac{1}{2}$ ins. in diameter. Greater permanence is given to the drain by attaching a hard steel ball or bottle expander to the rear of the cartridge; the expander enlarges the drain, leaving a hard polished surface, and closes up the slit left by the coulter.

The power required to pull the mole-plough is considerable, depending upon the depth and diameter of the moles

and the nature of the soil. The draught may be greatly reduced if furrows are opened up with a single-furrow plough before putting in the mole-plough itself.

It would appear that under Rhodesian conditions the work will be most cheaply and easily done if it is carried out as soon after the close of the rainy season, as the ground surface has dried sufficiently to give a grip for the tractor or oxen. The draining should be done before the land is ploughed (in the case of arable land).

Many different methods have been used for drawing the mole-plough, and may be grouped in two main classifications: (a) direct traction, and (b) cable traction. Direct traction is to be preferred whenever the draught is not too heavy, as being simpler and quicker and avoiding the cost of the cable and winch. Moreover, it is possible to avoid obstacles such as ant-heaps. Cable haulage is economical of fuel, since the dead weight of the tractor itself has not to be moved over the wet ground, and by proper gearing very heavy draughts may be handled.

Since mole-drains are made at a much shallower depth than other systems of under-drains, it is necessary that they should be placed much closer together. In fact, experience shows that more effective drainage is obtained by a large number of shallow drains than by a few large channels at greater distances apart. The actual distance between mole-drains will depend upon the nature of the soil. English practice indicates that the drains at about 18 ins. depth should be only 3 yds. apart, but it seems probable that for Rhodesian conditions this distance could easily be doubled.

Mole-drains require a steeper gradient than tile drains—firstly, on account of the greater resistance to flow, and secondly, because it is impossible to secure an absolutely uniform gradient, since the inequalities of the ground surface are reflected in the level of the drains. As a working limit, the gradient should probably not be less than one in two hundred, and a steeper gradient is to be preferred in order to produce a brisk flow, which will reduce the chance of clogging. The length of mole-drains of small diameter ($2\frac{1}{2}$ ins. to $3\frac{1}{2}$ ins.) is limited to about 200 yards.

Main drains, either open or piped, are required to collect and discharge the water from the moles. If a natural channel exists, so much the better. A short length of 2 in. pipe should be inserted into the end of each mole drain where it enters an open main drain to prevent damage through the trampling of cattle.

Mole-drains are not strictly permanent, but under favourable conditions are capable of giving satisfactory service for a number of years. In certain cases in England mole-drains 30 or 40 years old are still in use, but these particular drains were $3\frac{1}{2}$ ins. in diameter and relatively deep.

Tile-draining is being rapidly superseded in England as "impossibly expensive" in comparison with mole-draining, and the difference should be still more marked in Rhodesia, since mole-draining is a method which requires very little (beyond the actual mole-plough) in the way of purchased material, and the cost is therefore almost entirely composed of labour charges. Given conditions where the draught is not too heavy for a span of oxen (or a tractor), mole-draining offers a cheap and simple means of draining a piece of rich, wet land. A number of mole-drains have been drawn on a piece of typical black vlei on the Gwebi Government farm, and comments on the results were published in the "Rhodesia Agricultural Journal" of February, 1931.

Conclusion.—While it is not suggested that under-draining on an extensive scale has been necessary or warranted in Rhodesia up to the present, there are isolated lands on a great many farms which are potentially very valuable either for pasture or arable purposes, but are, for want of drainage, only a handicap to the general working of the farm. Where these wet patches are small, it is probable that a few well-placed French drains will cure the trouble, while mole-draining is applicable to land of greater extent.

Apart from under-drainage, it is important to take steps to prevent surface water collecting and soaking into low-lying land. This is a fruitful cause of water-logging, and, if surplus surface water is collected by a system of storm-water drains and contour ridges on the higher ground, it will be to the advantage of both types of soil.

Finally, a general word of warning should be sounded against the practice of indiscriminately ploughing up vlei lands. These lands are naturally exposed to the discharge of large quantities of storm water, and if the natural vegetative covering is once removed, there is nothing to stop the eventual formation of a large donga. The best practice is to leave a strip of 20, 30 or even 100 yards of natural grass (depending on the local conditions) in the centre of the depression, and if a channel is required for drainage purposes, it should be placed at the side.

Utilisation of Vleis.—The vleis of Rhodesia constitute a most important asset to the country, providing as they do one of the few sources of moisture available during the winter and spring and thus promoting in their vicinity green pasturage during the dry months. For the most part, however, they are capable of being rendered by judicious treatment of infinitely greater value than in their natural state. Speaking generally, they are excessively wet for the greater part of each season and are incapable of carrying summer crops or of producing grasses of high feeding value. The object of drainage is to maintain the moisture content of the land at a more uniform level throughout the year. Apart from its limited use for the growing of wheat and other winter cereals, little has yet been done towards the improvement of vlei land or its utilisation to best advantage. It may well be found that the most economic use to which most vleis can be put will be for the establishment of improved pastures, but even so some measure of drainage will usually be required.

It is necessary that the system of drainage should be as simple and cheap as possible, more so than is permissible for the drainage of good arable soil, although under English conditions no distinction is made. Leaving aside, therefore, the question of French drains and mole-drains (and, of course, tile-drains), it is obvious that some type of open drain must be used.

Where the improvement of the pasture is the objective, each case must be carefully considered on its merits, bearing in mind the type of pasture which it is desired to establish. Clovers apparently will not persist unless moisture is retained throughout the driest part of the year, within two

or three inches of the surface, and white clover is more tolerant of excessive moisture than of very dry conditions. In certain cases, therefore, care must be taken not to over-drain the land, and, if mixed grass and clover pastures are desired, it may be found sufficient merely to prevent excessive water reaching the land by reason of the run-off or percolation from higher lying areas adjoining.

In other cases, and particularly on heavy clay vleis which are unsuitable for clovers owing to the rapid drying out of the surface soil in winter, the land may be laid off in wide ridge and furrow, the furrows being shallow and of an easy rounded shape so as to offer little obstacle to the use of hay-making machinery. Here, for average conditions, it is suggested that the depth of the drains or furrows should be from 1 foot to a maximum of 2 feet, and 3 to 5 yards wide, the width of the intervening ridges being 10 to 15 yards. The system should be laid out with the drains parallel and dropping at the rate of about 1 in 100, either towards the centre of the vlei or, if there is a suitable longitudinal fall, parallel to the axis of the vlei. The gentle undulating shape is important to permit easy movement of the implements and will repay a little care in excavation, which may largely be done with a plough, Martin ditcher or dam scraper. The soil removed in the excavation should be spread out thinly over the elevated strip.

It is not advisable to leave the furrows to natural reversion to grasses, for this will be a relatively slow process, and meanwhile the disturbed soil will be taken possession of by weeds. Moisture-loving grasses should therefore be established in the furrows, those suggesting themselves being swamp couch grass, Hunyani grass, Rhodes grass and paspalum (dilatatum). The last two can be quickly established from seed, and, if this is the intention, it will be advisable to spread a layer, a few inches deep of the surface soil (previously removed) over the face of the furrow in order to provide a more congenial medium than sub-soil, in which young grass plants may establish themselves.

Submerged Dam.—A submerged dam is a device by means of which water percolating underground is checked in its flow and brought to the surface. In other words, an artificial spring is created. The chief condition necessary for

the success of a submerged dam is the existence of an impervious clay bed not far below the surface. A trench is carried down to, and into, this clay bed at right angles to the direction of percolation. The trench is then filled with good puddled clay, the thickness being proportional to the depth and not less than 3 ft. Clay for filling the trench should not be taken from the down-stream site, or there will be a risk of leakage.

A submerged dam can be used to provide a water-hole for cattle, or, if a sufficient stream of water is available, for the irrigation of adjacent land. In the latter case a small furrow is dug behind the dam and led away past one end of it.

Springs and "Sponges."—It is necessary to differentiate between the type of spring which appears usually at the foot of a steep rise at the head or side of a vlei, and the "sponge" proper, consisting of low-lying swampy ground full of decayed humus.

In the former case the vlei below the spring is not naturally a swamp, but is simply impregnated with water from the spring. If a submerged dam is made immediately below the line of springs and a furrow dug behind the dam, the spring water may be diverted from the vlei and either used for irrigation of a better piece of adjacent dry land, or may be led back to the low-lying ground whenever necessary. The vlei will then be relieved of its superfluous moisture and two pieces of land may be put to good use instead of none.

With the typical wet sponge it is usually necessary to go to the lower end and search for a place where an underlying clay bed comes close to the surface. If a submerged dam is made at this place, the sponge will continue to act as a reservoir and should not be interfered with. If a sufficient flow of water is developed, it may be diverted by a furrow and used for irrigation.

It is not usually possible to irrigate more than an acre or two from a seepage spring or sponge, but if conditions are favourable, the submerged dam may sometimes be extended above ground level in the form of an ordinary low earth dam, which will increase the usefulness of the scheme.

Veld Burning.—Although the burning of rank grass on a vlei is occasionally a necessary measure, the general practice

is one to be deprecated, since the burning of the natural covering of grass exposes the soil to the direct heat of the sun, opening up cracks (in the case of black soil) and desiccating the soil, so that the valuable asset of moisture during a dry winter is wasted by evaporation instead of being put to good use by drainage, cultivation and fertilising.

Another dangerous practice is that of opening up a spring or sponge indiscriminately, and it is strongly recommended that engineering advice should be obtained before taking any such steps.

GWEBI PRODUCE PRICES.

Hull-less oats	40/- per bag of 150 lbs.
Large Black sunflower seed ...	14/- per bag of 100 lbs.
Dolichos beans	35/- per bag of 200 lbs.
Linseed	60/- per bag of 200 lbs.
Linseed (quantities under 100 lbs.)	4½d. per lb.
Sweet potato tubers (Calabash Leaf)	6/- per bag of 150 lbs.
Napier fodder roots	6/- per bag of 40 lbs.
Sweet potato cuttings (Calabash Leaf)	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.
Pumpkin seed	1/1 per lb.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

REPORT OF THE REGISTRAR OF CO-OPERATIVE SOCIETIES

FOR THE YEAR 1931.

Number of Companies Registered.—The number of co-operative companies registered at the date of this report is eleven.

Only one new organisation was registered during the year, namely, the Midlands Farmers' Co-operative Company, Ltd. This was established at Gwelo to take the place of an unregistered Association of farmers which had for some years operated a maize pool with a good measure of success. The development of the business had made legal incorporation very desirable.

Two Associations which were registered last year commenced business operations during the period under review. One of these, the Dairymen's Co-op., Ltd., is a combination of producer-distributors of milk in Salisbury, whom circumstances forced to embark upon methods of co-operation. The company has met all the difficulties commonly experienced by an organisation undertaking an intricate task, and the results have not been all that the members hoped. They are, however, according their loyal support, and the future of the company can therefore be contemplated with some confidence.

The second Association was the Producers' Direct Supply Co-operative Company, Ltd., which was established to market vegetables, fruit and other perishable products on behalf of its members by retail. This is one of the most difficult types of co-operation, but the company seems to be receiving good support and to be extending its business. Its first financial statements have not as yet been received.

During the year, three Co-operative Companies interested themselves keenly in the possibilities of co-operative purchases of farming requirements for their members. Means of developing this activity have been closely discussed, the

Department providing what advice and assistance was possible, but the farmer's need of credit in respect of his purchases has prevented much progress being made.

Liquidations.—There were no liquidations during the period under review.

Trade Investigations.—During the year the Registrar carried out an investigation in the Belgian Congo in the interest of Southern Rhodesia's trade in agricultural produce with that territory.

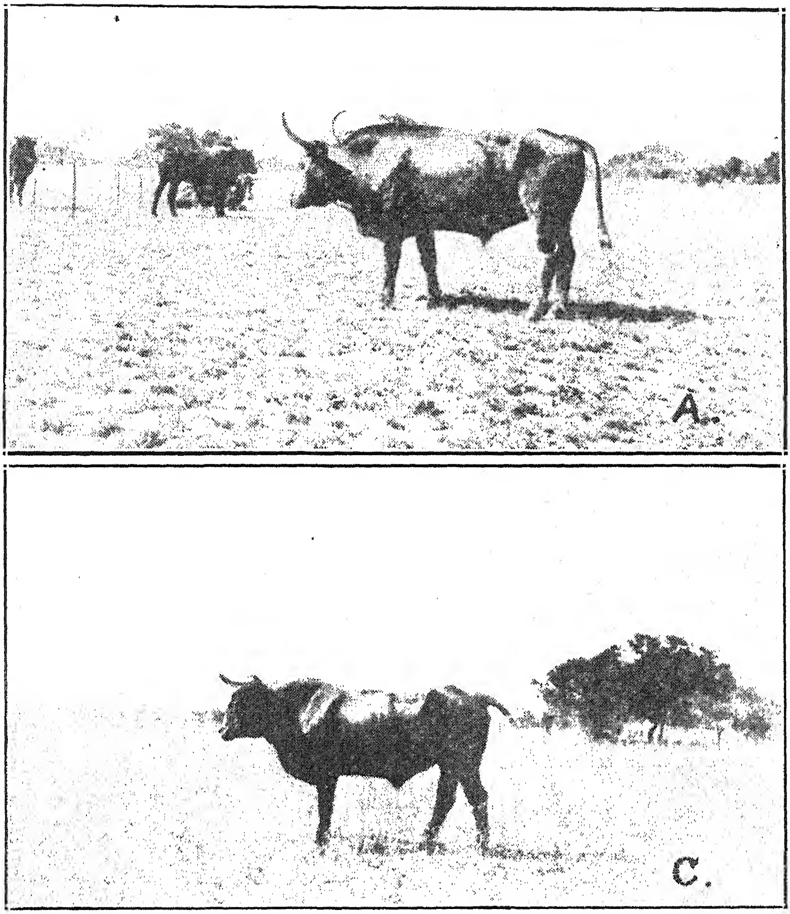
Another investigation was made at Beira in connection with the possibility of developing a market for vegetables and other perishable products in that port.

Maize Control.—The Registrar having been appointed chairman of the Maize Control Board, a considerable portion of his time has been devoted to the affairs of the Board. The Board commenced operations in terms of the Maize Control Act on the 5th June last. At the date of this report (31st January, 1932), it has received into the pool a total of 1,148,236 bags of maize, of which it expects to export approximately 50 per cent. Its sales total 693,354 bags.

The total European crop for the season 1930-31 has been returned at 1,436,000 bags, and in addition some 138,000 bags of native maize were traded. This gives a total of 1,574,000 bags. Of this quantity, 360,000 bags appear to have been retained by producers for their own consumption.

The Board proposes to make a first interim cash distribution of 3s. a bag within the course of the next few weeks. The distribution will be due to holders in due course of Participation Certificates, and, in the instance of participants in the pool who have had advances on the certificates issued them, it will be applied to the repayment of such advances.

The Board's financial year terminates on the 31st May, 1932, and a full report on its transactions will be prepared as soon as possible after that date.



Difference in grazing rate at end of grazing period.
A. Heavy grazing paddock. C. Light grazing paddock.

PRELIMINARY NOTES ON INTENSITY OF GRAZING EXPERIMENT.

By D. G. HAYLETT, B.Sc.(Agr.), M.Sc., Ph.D.; C. A. MURRAY, M.Sc.(Agr.); and F. T. ERIKSSON, Dip.Agr., Matopo School of Agriculture, Rhodes Matopo Estate.

A considerable amount of prominence has been given to the question of close, intermittent grazing during the last few years, particularly in humid climates. As an agronomic problem, it is a field in which there is promise of greater achievement than in any other phase of crop production. The initial impetus was supplied by the success of the German Hohenheim method of heavy fertiliser treatment and rotational grazing (McConkey, 1931*). In the British Isles this work has been further developed by the investigations of Woodman and his co-workers (1926, 1927, 1928, 1929, 1930).

The focus of attention on the whole problem of grassland management has now made it an Empire-wide research project with ramifications throughout the British Dominions.

Under humid climatic conditions it has been shown that the feeding value of pasture, especially with regard to protein and mineral content, can be maintained at a high level for a longer grazing period than if the pasture is allowed to become rank. Apparently close-grazing, judiciously practised, does not impoverish the pasture, but tends to improve it.

Under semi-arid conditions, however, whereas close grazing may prolong the feeding value, as shown by the work of Husband (1931), nevertheless it is not yet known to what extent this heavy grazing will ultimately result in a degeneration of the pasture. The work of Staples (1928) at Cedara, Natal, showed that even under the relatively high rainfall of

* Reference to literature cited at end.

Natal, continuous close-grazing cannot be practised for more than one year out of two or three, without marked harm being done to the pasture.

The present experiment was designed in the first instance to determine the effect of different intensities of grazing on the botanical composition of a fairly typical sandveld pasture, under the climatic conditions pertaining to this area. The results of this experiment should enable a sound, practical recommendation to be made with regard to the management of similar types of grazing in order to obtain the maximum carrying capacity without harmful over-grazing. The experiment is in progress, but cannot be brought to finality until a period of years has elapsed.

Previous History.—The experimental paddocks were originally part of a large, partially fenced area, east of the tobacco barns, between the Malemi River and Matopo Hills. For the reason that it was only partially fenced, it is probable that it was never very heavily grazed. Since June, 1930, this area has not been grazed, except occasionally by a few native cattle and the oxen working on the main road.

The area was burned during the late winter of 1931 and was burned similarly during the winter of 1930. The grazing history prior to this time is unknown.

The veld was considered typical, average "sour" sandveld by the Botanist, Department of Agriculture. The grass species at the commencement of the experiment were recorded by means of twenty permanent quadrates in all, five quadrates being located in each paddock. These data should provide a very good index to the botanical composition of the site.

A uniform area of eleven acres was selected and fenced into four paddocks as shown in Fig. 1. Five permanent quadrates were located in each paddock on the position shown in Fig. 1, and from the main basis for gauging the change in the pasture.

A standard grazing unit of three head of cattle and fourteen sheep was used, and the different intensities of grazing were obtained by varying the size of the paddock while keeping the grazing unit and the number of grazing days constant. Thus Paddock A, 2 acres, carrying the same number

of animals for the same number of days as Paddock B, 3 acres, was more heavily grazed than the latter, and Paddock C, 4 acres, under these conditions was grazed with half the intensity of Paddock A. This is a new departure in grazing technique and appears to be working well, the idea being to eliminate variability due to all causes except the intensity of grazing. The effect of group individuality in the grazing units was reduced by random group selection at the beginning of each grazing period. A record is being kept of the number of grazing days per season with the usual gross observations on the animals and pastures.

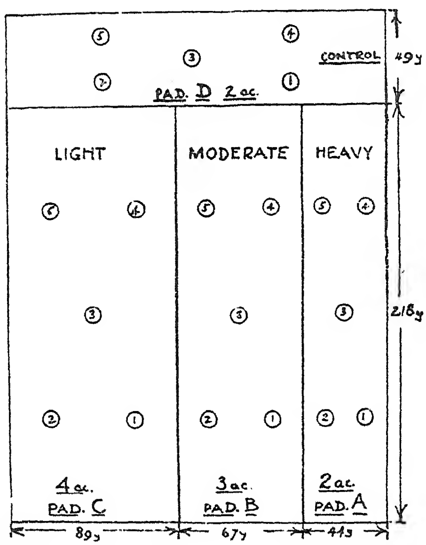


Fig. 1.—Diagram showing arrangement of paddocks and location of permanent quadrates.

Grazing was commenced in each case when the grass in Paddock A was about 9 to 12 ins. high, but before the bulk of the grass was in flower. Grazing was discontinued on all plots when Paddock A was eaten close, practically no leaf and no flowering heads remaining. At this stage all the animals were removed from each paddock, which was allowed to recover until there was sufficient new grass in Paddock A to start a further period of grazing.

PRELIMINARY RESULTS.

Grazing Data.—Grazing commenced on 12th December. Thirty oxen were allowed to graze over the whole area, which had been fenced only on the outside. The internal division fences had not been erected, and it was considered essential to graze to prevent the grass seeding. After the whole area had been grazed at an average rate of 13.64 beasts per acre for one day, the animals were withdrawn.

The second and third grazing periods started on 31st December and 2nd February respectively, with three bullocks per plot.

The fourth, fifth and sixth periods started on 26th February, 29th March and 7th May. After this grazing the plots will be allowed to remain over until the spring of 1932, when grazing is to be continued on the same basis.

The intensity of grazing represented by the number of days one bullock would have grazed one acre averaged 70.34, 51.44, 41.98 and 13.64 days for Paddocks A, B, C and D respectively. The number of grazing days in any particular season will depend on climatic conditions and resultant growth of the pasture.

In order to bring the grazing by sheep to the same basis as grazing by oxen, the factor 0.15 as given by Fraps (1924) has been applied.

The difference between the paddocks became increasingly marked as the number of grazing periods increased. At the close of the season the difference as illustrated was striking. It is anticipated that the accumulation of old grass in the lightly grazed Paddock C will present a problem after the experiment has been in progress for a few years. This will probably introduce a secondary factor which will have to be provided for at a later date.

The animals throughout the experiment tended to avoid the seed heads of *Cymbopogon excavatus*, *Pogonarthria squarrosa* and *Hyparrhenia* spp. in Paddocks A, B and C.

Botanical Analyses.—The detailed botanical analyses from five quadrate determinations in each of the four paddocks have been carefully noted. There are 24 grasses and

32 miscellaneous plants belonging to other families, most of which have been identified. The experiment is particularly concerned with the grasses, but it will be of considerable interest to ascertain the increase or decrease of the legumes and other plants as a result of protracted treatment.

The grasses appear generally in the following order of frequency:—

1. *Digitaria milanjiana.*
2. *Eragrostis* spp.
3. *Pogonarthria squarrosa.*
4. *Hyparrhenia* spp.
5. *Heteropogon contortus.*
6. *Cynodon dactylon.*
7. *Rhynchelytrum roseum.*
8. *Aristida* spp.
9. *Shizachyrium Jeffreysii.*
10. *Sorghum micratherum.*
11. *Cymbopogon excavatus.*
12. *Crossotropis grandiglumis.*
13. *Andropogon shirensis.*
14. *Trichopteryx simplex.*
15. *Brachiaria serrata.*
16. *Perotis indica.*

Acknowledgments.—Acknowledgment is made for the invaluable assistance given by the members of the Division of Plant Industry, Miss S. M. Stent, Senior Botanist, and Mr. J. M. Rattray, Botanist, in identifying the grasses and other plants referred to in the paper and offering valuable suggestions, and to the Senior Animal Husbandry Officer, Dr. A. E. Romyn, for his advice and criticisms.

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FARMING CALENDAR.

August.

BEE-KEEPING.

This month is one of inaction as far as the apiarist is concerned and the hive inmates are best left alone, except that once a week a corner of the quilt on the top crate may be lifted to see if the wax moth has gained a footing, as it may do in a colony weakened by death from sundry causes, and in which case all such frames should at once be removed. Towards the end of the month, with warmer weather, the bees will be tempted out for play spells, cleansing flights, etc., and, according to the season, entrance stops may be opened out slightly with advantage.

In the workshop see that a spare hive or two are in readiness, well painted and ready for use at any hour; also have in readiness any requisite spares, and see that all appliances, such as veil, smoker, fuel, etc., are handy, for swarms may now go and come at a few minutes' notice. Where the bees have been left to their winter quarters with a fair supply of food, good results can confidently be looked forward to for the coming honey flow of the early winter weeks.

CITRUS FRUITS.

The first or spring growth should commence about the middle of the month, and the trees should have a good soaking of water when the new growth commences. If Washington Navel oranges are to set their main crop, frequent irrigations must take place from the time of blossoming up to the rainy season. These irrigations create the necessary humid conditions which are so essential to secure a satisfactory setting of this orange. It is advisable to stimulate the growth of unthrifty trees with an application of one to one and a half pounds of nitrate of soda when the first irrigation is given, this application of fertiliser to be followed by good cultivation. The amount of fertiliser recommended is for mature trees. The packing of late varieties will continue throughout the month. No bearing trees should suffer for want of moisture. Irrigation should not take place immediately before the harvesting of export fruit—at least ten days should elapse between irrigation and the harvesting. This is the best month to cut down citrus trees for re-working to better varieties. As the citrus trees are harvested, all dead, diseased and broken branches and shoots should be carefully cut out before the trees come into new growth.

CROPS.

If not already marketed, the main potato crop will probably be sold about now. Do not forget to grade the potatoes properly according to size. The buyer wants potatoes—table or seed—of even size, not large and small indiscriminately mixed. Select and clean farm-grown seeds ready for next season's planting. Label the bags with name and weight of contents. Build a proper shed for your seed potatoes on the lines recommended in the *Rhodesia Agricultural Journal*. Sort over seed potatoes in store and remove any diseased or rotten. Green oat or barley fodder on wet vleis,

or under irrigation, will become ready for cutting. Press on with ploughing and cross-ploughing. Decide what crops are to be grown next season, and, if you think fit, discuss the matter with officers of the Department of Agriculture. If you have not already effected all your purchases, consider the question of what seed you will require to buy for next season, and discuss the matter with other farmers. If in doubt, consult the Department of Agriculture. In frost-free situations, potatoes can be planted for an early crop under irrigation or on damp land. Cart and spread your farmyard manure and plough it under as soon as spread to avoid loss. If you have any long stable manure, apply it to your heaviest land. The application of phosphatic fertilisers to the land can continue. If you do not already have one, put up an implement shed, even if it be only poles and grass. Keep wagons and Scotch carts under a similar shed or in the shade of trees. Speed up the making and burning of bricks if this is still in progress.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. As a rule the weather is sufficiently cold to prevent cream, produced under average conditions, from undergoing rapid deterioration, and it is not usually necessary, therefore, to separate a cream of such high butter fat content as is required during the warmer months of the year. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. Cream can quite easily be cooled to churning temperature if placed outside the dairy and exposed to the atmosphere overnight. During cold weather, however, it is more frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

This is usually a critical time of the year for young dairy stock. For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

DECIDUOUS FRUITS.

All plantings of deciduous trees should be completed by now, as the late planting of these trees is generally unsatisfactory. Pruning may be continued up to the middle of the month. It is advisable to water or irrigate all deciduous trees before blossoming; if possible, a second irrigation should be given after the trees have set their fruit. Follow up the irrigations with good cultivation.

ENTOMOLOGICAL.

Potato.—Early planted crops of potatoes may be attacked by caterpillars. The crops should be sprayed immediately with arsenical wash such as lead arsenate powder, $1\frac{1}{4}$ lbs. to 40 gallons of water.

Cabbage Family.—Young plants of this family should be kept sprayed with an arsenical wash to check attack by web-worms. The formula given for potatoes with the addition of $\frac{1}{2}$ to 1 lb. of spreader to every hundred gallons of spray should be effective. If cabbage louse is also present add

tobacco extract, 1 part to 80 parts spray. Do not spray plants of which the foliage is to be eaten within three weeks.

Citrus Trees.—May be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine tobacco wash or Derris.

Guava.—Collect and destroy remnants of late crops to keep down citrus codling, especially if trees are in vicinity of citrus orchards.

FLOWER GARDEN.

Complete digging or forking over the soil as early as possible. Divide and replant dahlias, delphiniums, Shasta daisies, etc. Plant bulbs—tuberose, arum lilies and gladioli. Sow seeds of hardy annuals. Mulch newly-planted roses, shrubs, etc.

VEGETABLE GARDEN.

Plant out asparagus, cabbage, cauliflowers, onions and early potatoes. Sow seeds of tomato and other plants that are susceptible to frost in a sheltered position; also seeds of various vegetables and salads for summer use.

FORESTRY.

Cuttings of ornamental shrubs, roses, etc., struck in sand last month should be transplanted into good soil as soon as they show a good healthy growth of leaves. A large percentage of cuttings will damp off if left in sand longer than about six weeks. No manure should be added to the potting soil. Seed beds should be prepared and gum seeds sown if required for planting early in the season. If the trees are to be grown in seed beds only and not in tins, then gum seeds should not be sown until October, or later, as they will get too large.

GENERAL.

Fire guards should be completed and every precaution taken to guard against loss of grazing from fires. Natives commence ploughing their softer land this month, and for this reason, as well as because beer is plentiful at the kraals, local labour is apt to be scarce. At this time of the year, however, the need for boys on farms is not so severely felt as later on.

POULTRY.

By the end of this month all those who are not able to give much attention to the chicks while in the growing stage should have stopped hatching. Those who can give some extra care, can continue hatching for another month, but not later, for chicks hatched after August are usually slow in growth and weedy. They do not lay till some months after they should, and eggs are few in number; in fact, they are generally unprofitable.

Now that the hot weather is approaching, a constant war on insects must be carried out, and of these sand fleas and fowl ticks (erroneously called tampans) will be found to be the most troublesome. A bulletin on fowl ticks can be obtained upon application to the Poultry Expert, Department of Agriculture. Sand fleas, as most poultry keepers know, are found on the face, wattles, ear-lobes and combs of the birds. Application of carbolised vaseline will usually kill them at once, or two or three applications of any ordinary grease on successive days are efficacious. More than this is, however, necessary, for the breeding quarters of these insects (and they multiply very rapidly) are in the dust on the floor of the house and that of the run.

The best preventive is a hard floor (preferably of concrete) with no cracks. If this is not possible, the floor and around the house should

be treated every week in one of the following ways:—(1) Thorough soaking with a solution of one teacupful of Kerol, Jeyes, Hycol, Izal, or similar disinfectant to a paraffin tin of water, or (2) with a strong solution of salt and water, or (3) dusting over and raking into the soil a mixture of one part flowers of sulphur and two parts finely powdered lime.

Ducks.—See that the breeding ducks have plenty of water, and if possible also some to swim in. Keep young ducklings out of the hot sun, otherwise there will be many deaths. The same applies to geese and goslings.

Turkeys.—Young turkeys must be protected from cold at night, for this is fatal to them. Give them as much free range as possible, and do not allow them to run round the house or on the same ground as fowls do. Turkeys like clean ground; any that is tainted is very detrimental to them. Let them find most of their food in the bush.

STOCK.

Cattle.—On the early granite and sand veld probably the worst of winter is over so far as grazing is concerned, and a nice bite of green grass is appearing. Care should be taken where cattle are allowed to graze on the early burnt grass not to let them get too much at first. On red soil farms the haystack will still be required, and in all cases a certain amount of hay or ensilage should be held in reserve against the possibility of very late rains. In dairy herds on any soils whatever, feeding, housing and bedding should not be relaxed. A satisfactory ration for a medium producing cow in full milk is 5 lbs. of maize, 30 to 40 lbs. of ensilage or pumpkin and 8 to 10 lbs. of hay. If it is possible to give, in addition to the above daily ration, 2 lbs. of ground nuts, crushed with the shell, or oil cake, a very great benefit will be derived. Full particulars of the rationing of dairy cows can be obtained on application to the Department of Agriculture. Calves, especially young ones, must be carefully watched; they should not run too far, and are better inside, except when the weather is warm. They should be fed a little sweet hay, bean meal, linseed, ground nuts or ground nut cake and a small ration of green food.

Sheep.—Sheep should give little trouble at this time of the year. In many places now they will be grazing on the early "burns." The ewes and lambs should be given the best grazing available.

TOBACCO.

The seed bed site should be cleared and well ploughed, preparatory to burning and sowing. The usual date of sowing the first beds is the 15th September. Bulletins covering every phase of tobacco culture can be had upon application to the Editor.

VETERINARY.

Redwater and gall-sickness occur all the year round, although these diseases are more prevalent during the summer months. A good many deaths occur this month, however, amongst imported stock. Vegetable poisoning will probably be in evidence. Sheep can be inoculated against blue tongue. Scab is a poverty winter disease.

WEATHER.

No rain is to be expected, and even on our eastern mountains the precipitation is trifling. Showers, however, do occasionally fall in places, but are of no consequence. The sun is often warm during the day, but the nights are apt to be cold, and grazing being scarce, food and shelter are necessary for the stock.

September.

BEE-KEEPING.

This is an important month for the bee-keeper, as it starts the first flow of the season. All hives that were sent into winter quarters on a double brood chamber, or otherwise with ample food for that period, should now be overflowing with young in all stages and with a population large enough to take full advantage of the flow. All hives should be carefully examined now and again, entrances opened out to suit the advancing warmth of the weather, and where necessary ventilator lids replaced on the top crates under the hive lid. See that no worry is caused to the bees by ants getting up, and that ample stores of good water (with a pinch of salt and a dash of vinegar) are available for drinking purposes, of which bees consume quite a lot. Swarms can now be looked for; if not required, they can best be destroyed by carbon bisulphide or calcium cyanide—both requiring very careful handling. If it is wanted to increase the apiary, as soon as the scouts are seen looking round for a home, get the decoy hive ready filled with dummy and proper frames of full foundation sheets, or, better still, if they are available, old drawn out brood combs, and as soon as it is taken possession of, insert if possible a frame or two of unsealed brood. As a rule the swarm will settle down at once. Such a colony is best placed in the apiary the same evening, if it can be so arranged. Do not make the mistake so often seen of supplying the new colony with starter frames only; give them full foundation sheets; it pays every time, and more especially so in the first early honey flow. Be sure also and protect the apiary against that persistent robber, the honey bear or ratel, by fencing it with fowl netting and pegging that down with wooden pegs every two feet. The two-footed robber can be just as effectively dealt with by placing a small light chain round the entire hive fastened with small staples and a padlock.

CITRUS FRUITS.

The fate of the citrus fruit crop is dependent upon the treatment the trees receive during this month. If the trees have been given the treatment recommended in the August calendar, and this treatment is followed by good irrigations and cultivation, a good crop of fruit may be expected, whereas a total failure will be the result if the trees suffer for want of moisture at this season of the year.

If not already done, all top worked trees should be headed back early in the month. This cutting back will induce the dormant buds (set in autumn) to commence growth. As the new shoots develop the old tops may be further shortened back until the old top is displaced with a new but profitable one.

The packing of late varieties must be speeded up and completed, if possible, by the end of the month, as the late picked fruit is likely to deteriorate in quality or come into competition with Mediterranean fruits.

All adventitious shoots (water shoots and suckers) must be cut off as they appear, and this work should be continued throughout the growing season.

CROPS.

Utilise your labour to the fullest extent for stumping and clearing more land for mixed crops and for general farm development. Do not be satisfied unless each year sees more profit-earning development work effected. Good organisation of the farm work will permit of much being done without great cost. Begin marking out holes for hand check-row planting of maize, and apply manure or fertiliser. Fertilisers which are to be broadcasted and ploughed or harrowed in can be applied. Do not

forget that lands which have been green manured in March or April will require a second ploughing about this date or before being seeded to crops. Early varieties of winter cereals ripen this month and require harvesting. Danger from frost should be past now, and crops susceptible to frost, such as potatoes, onions in beds for the summer crop and Jerusalem artichokes, may be planted where lands are moist. Pumpkins and early maize may be planted on vlei lands. Edible canna may be planted "dry" during the latter half of this month, where some rains may be expected during next month. Overhaul all implements and replace worn parts. Putting this off till the planting season may mean serious loss of planting opportunities between rains. Get out the planters and seed drills. Overhaul and place them in proper working order. Ploughing and cross-ploughing should be hurried on with; also the ploughing under of farmyard manure. A spiked roller can usefully be employed for breaking down clods, particularly on those lands which are to be planted first. Make every effort to secure as good a seed-bed as possible; good seed-beds mean good stands, and good stands are all-important in securing good yields.

DAIRYING.

This is generally the quietest month of the year from a dairying standpoint. Most farmers have by this time exhausted their supplies of winter feed and the production of dairy products is consequently at its minimum. Town milk supplies are now falling off, and a greater use of purchased concentrates in the form of ground nut cake and bran is advisable to keep up the milk supply. Very little cheese is made during this month and stocks are naturally low. Old cheese should be cleared out of the storeroom before the advent of hot weather, and if possible should be sent to be stored under cold storage conditions. Considerable difficulty is to be expected in making butter during this month, as the early spring grass is shooting in the vleis and the butter is consequently very soft. To counteract this, greater use should be made of cotton seed cake, of which a small supply is expected to be available this season.

DECIDUOUS FRUITS.

Newly planted trees must not be permitted to become too dry; watering by hand or gravitation must be continued until the rains commence. Ten gallons of water every fourteen days is sufficient for young trees; these applications should be followed by the loosening of the soil to prevent undue evaporation of the added moisture.

All undesirable growths on the stem and in the centre of the trees should be suppressed as they appear; this will enable the retained shoots to develop normally.

Early fruits must be thinned out this month; only retain two or three fruits on each bearing twig or shoot. Those that are left will then develop into large and attractive fruits.

ENTOMOLOGICAL.

Cotton.—Prevention for most of the boll-worms will be the proper preparation of the ground, with thorough cultivation and eradication of all weeds on the land, particularly those of the family Hibiscus. Wild host plants for stainers should be sought out and destroyed.

Tobacco.—Young plants in seed-beds may suffer from cutworms. Frequent cultivation and laying down of poisoned bait—50 lbs. bran and 21 lbs. Paris green; bring to consistency of a stiff dough, adding water when necessary. Distribute this over the seed-beds in the forenoon, as the cutworm does most of its feeding at night. The beds should be thoroughly burnt over with wood or dry tobacco stalks to ensure that the seed-beds are free from cutworms, and baiting for any coming in from the surrounding ground should then be resorted to when the plants appear. Clear the ground for some distance round the beds, say 30 yards in all directions, and bait this ground thoroughly before sowing—

this clearance allows a wide margin over which the cutworms would have to travel. Cutworms' moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night; this should be seen to each evening.

Potato.—Early potatoes are liable to suffer from caterpillars. The crop should be sprayed at first sign of injury with an arsenical wash.

Cabbage.—During this month the most prominent enemies of plants of this family are diamond-back moth and web-worm. Cabbage louse is sometimes troublesome. The young plants may be sprayed or dusted with an arsenical compound for the former, and sprayed with tobacco wash and soap for the latter.

Beans.—Planted under irrigation during September usually escape serious infestation with stem maggot.

Citrus.—Throughout the month lime-sulphur spray (1-100) may be used to control yellow citrus thrip whilst on very young fruit. A useful spray against black aphis and thrip is the following:—Nicotine, 9 ozs.; Capex spreader, 7 ozs.; water, 100 gallons; Capex lime-sulphur, 1 gallon. This may be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine, tobacco wash or Derris.

FLOWER GARDEN.

Cultivate extensively to prevent evaporation and to keep weeds in check. Water plants newly set out, especially such as have their roots near the surface. Thin and regulate growing shoots on roses and various shrubs. Plant out cannas and chrysanthemums (for massing and border decorations) and other herbaceous plants.

VEGETABLE GARDEN.

Sow French beans, leek, spinach, cucumber, egg plant, celery, rhubarb, melons and tomatoes. Small sowings of peas, turnips, beet, lettuce, radish, carrot, parsnip and cabbage may be made now.

FORESTRY.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. Preliminary sowings of eucalypt seeds should now be made on a small scale, so that transplants will be ready in case the first half of the rainy season should prove favourable; otherwise, bulk sowings should be postponed to October-November.

GENERAL.

Indigenous labour is apt to become more scarce at this time of the year, the boys returning to their kraals to break up the land for next season. Stock are liable to stray in search of the young grass now coming up, and much trouble from this cause is to be looked for on unfenced farms. Natives are now cultivating their gardens preparatory to sowing their crops, which they do much earlier than do Europeans. The mischief caused by veld burning becomes apparent from this time onwards in the condition of the stock, and it is necessary frequently to move them away in search of grazing.

POULTRY.

The supply of green food to the birds must be kept up; in fact, during the hot weather they require more.

During our dry season the available supply of such green foods as lettuces, cabbages, sunflower leaves is much reduced, but there are many others that can be used, such as belhambra, plumbago, wild cockscomb, plantain leaves, paw-paw leaves, etc. Sprouted oats, barley and wheat should also be used. Many of the young cockerels should now be fit for killing. Keep the best and get rid of the remainder. It is very advisable

to caponise all young cockerels when about $2\frac{1}{2}$ lbs. weight. The "Rhodesia Agricultural Journal" of October, 1924, and Bulletin No. 517 give clear and concise details as to the method of performing the operation. Some of the earliest hatched young pullets will show signs of commencing to lay now. No light breed bird should lay until it is 5 to $5\frac{1}{2}$ months old, or a heavy breed until it is 6 to $6\frac{1}{2}$ months old. Should any show signs of commencing to lay before this, they should be moved from run to run to prevent their doing so. A bird that lays before it is fully matured will stop growing, will always be small, and its eggs will for its first year of laying also be small.

When the pullets are four months old, i.e., those of the light breeds, they should be put into their permanent laying quarters, and those of the heavy breeds when they are five months old. A bird that is moved after it has started to lay will stop and very probably go into a moult.

See that young ducklings get plenty of shade during the hot weather. Those destined for killing should not be allowed free range or even a medium-sized run, but should be kept fairly crowded in small runs. It is necessary to get the flesh on them as quickly as possible, and the more rest and less exercise they have, the more rapid will be the growth, and also more succulent and tender the flesh.

The hatching of turkeys should proceed rapidly and be carried on until the end of the dry season. See that they have plenty of chopped onions or onion tops or eschalots, and thick separated milk. These are absolutely necessary if the turkey breeder wishes to be successful with his rearing. Do not give wet food; dry mash such as given to chickens is the better.

STOCK.

Cattle.—Ranching cattle should require little now in a normal season; it is only in the event of very late rains that trouble should be expected. Where possible, it will be wise to keep an eye on those cows that may be expected to calve early, with a view to feeding them if necessary and seeing that they do not get too poor. The supplementary feeding of ranch stock is always a difficult problem. But a small provision of cotton seed, good veld hay, kaffir corn or sunflower silage at this time may be the means of saving many head of cattle when the rains are late. This is a critical month for young stock. Weaning should be completed as soon as conditions permit. The dairyman will carry on much as in August; he will, however, use his discretion (in accordance with the condition of his veld) as to the use of ensilage, pumpkins or other bulky and succulent food. He will be wise not to shorten the supply of concentrated foods for some time to come. A little hay or ensilage should still be kept in reserve until the rains have fallen in reasonable abundance. The object should be to build up the condition of the cows expected to calve when the rains come.

Sheep.—The remarks for August apply. Feed up and shear the rams ready for mating for winter lambs.

TOBACCO.

Hasten the preparation of seed-beds for flue cured type of tobacco. The first batch of beds should be seeded about mid-September; subsequent seeding of the remaining seed-beds should be done (in batches) at fortnightly intervals. The last lot of beds normally is sown by the end of October. Seed-beds for dark fire cured type of tobacco should be prepared for seeding which commences after the first week in October.

VETERINARY.

There should be very few deaths from redwater and gallsickness this month. Cases of vegetable poisoning of stock picking up tempting young green shoots of dangerous character on the burnt veld are of frequent occurrence. Sheep can be inoculated against blue tongue, but ewes in lamb should not be treated, on account of the danger of abortion. Scab may be prevalent.

WEATHER.

The temperature may be expected to rise steadily during this month. Rains are not due until next month, though the average over a period of years shows slightly more than in the previous four months, and ranges between .1 and .5 inch. Frost has been known to occur in September, although this is a very unusual event. Rain-gauges should be seen to before the rains commence. They should be carefully adjusted to stand exactly level with the lip four feet above ground, and care should be taken that no tree, building or other obstruction interferes with the fair precipitation of rain into the orifice.

SOUTHERN RHODESIA VETERINARY REPORT.

May, 1932.

AFRICAN COAST FEVER.

MELSETTER DISTRICT.

Roede.—The temperaturing of the infected herd, removed from this farm to Welgelegen, was completed. No cases of Coast Fever occurred.

Melsetter Commonage and Sawerombi.—No further cases.

Rocklands Estate.—The Constantia and Clifton herds were moved to fresh veld and short-interval dipping carried out, but the mortality continued, showing that this veld was infected previously. No cases of disease amongst the other herds on this estate. Arrangements are being made to move the infected herds to a temperature camp on clean veld.

The total mortality from Coast Fever during the month was 89 head.

Laughing Waters.—Post-mortem examination of a beast on this farm showed lesions that suggested Coast Fever, and microscopical examinations confirmed. On the adjoining farm, Newcastle, a sick beast was destroyed, and post-mortem and microscopical examinations showed Coast Fever. The total mortality at Laughing Waters was four head, and as these cattle had been dipping at the Newcastle tank, it would appear that the disease first appeared on the former, and that Newcastle was infected by the cattle going to the tank.

Arrangements were made to move the infected herds to a temperature camp on clean veld.

Glencoe.—A fresh outbreak occurred on the farm Glencoe, adjoining the Tilbury Estate. Mortality, two head.

FOOT AND MOUTH DISEASE.

Gwelo Veterinary District.

A fresh outbreak occurred on Ghoko Block involving about 7,500 head of cattle. All herds were concentrated at the dipping tank, located about the centre of the block, preparatory to inoculation.

On the Aberfoyle Block the inoculation of all herds, numbering 6,258, was completed on the 13th, and the resulting re-actions were most satisfactory.

At the farms Umlangana and Dorset the cattle were recovering rapidly.

Umvuma Veterinary District.

On the Central Estates fresh infection appeared in three paddocks.

Victoria Veterinary District.

Infection was discovered at the Headquarters Section, Nuanetsi Ranch, amongst four mobs of weaners. During the months of January, February and March 499 calves were moved from various sub-sections to central weaning kraals about four miles from Headquarters. The last removal took place on 25th March last and the disease was discovered on 4th May. The infection is undoubtedly a recent one, as in no case were the lesions of more than fourteen days' standing. As far as could be observed only calves born since the disease passed through this section last year are affected.

The source of infection in this case is difficult to account for. All sections of the ranch infected in the first instance were reported as free from infection at the end of June last, and since then there has not been the slightest suspicion of disease on any of them. In March last disease was discovered on that part of the Mtilikwe section lying between the Mtilikwe and Tokwe Rivers caused by infection either from the Mukorsi River Ranch or the Nyadjena Reserve to the north. There has been no movement of ranch cattle

from the Mtilikwe section to any of the other sections for a very considerable period. There have, of course, been the usual movements of ranch officials and mechanical transport between Mtilikwe and Headquarters, but our experience is that infection is rarely, if ever, carried by either.

The most likely source of this fresh infection at Headquarters is the illicit movement or straying of native cattle either from the Mtilikwe area on the east or the Belingwe and Gwanda areas on the west. Several movements of cattle of this nature have recently been detected on the Ranch, and as the area involved is so large, it is certain many such movements take place without detection.

All other previously infected areas in this veterinary district are now considered free from disease.

Bulawayo Veterinary District.

Insiza and Gwanda Areas.—All the cattle concentrated and inoculated in the Bankwe, Senga and Indhlela dipping tank areas were permitted to return to their kraals. The inoculation of the cattle concentrated from the Anglo-French Block and other farms in the vicinity was completed on 1st May, and at the end of the month all were ready for return to their respective kraals. The Grimstone, Lukotsi and Dumbarton herds recovered completely.

In the Onderbrook and Ladi areas inoculation was completed on 12th May.

On 23rd May infection was located on the Donkerhoek tank area and all the cattle involved were moved to Onderbrook for inoculation.

On 26th May the disease was discovered in the Siwazi tank area and in the southern section of the Insiza Reserve. A cattle-free belt was established to the west and north of these areas and arrangements made for the inoculation of all cattle within the cordons.

At Liebig's sub-camp VII. all cattle showed good reactions to inoculation and recovered completely.

TRYPANOSOMIASIS.

Five cases recorded on the eastern border, Melsetter district, and twelve in the Bubi district.

HORSE-SICKNESS.

Eleven cases reported.

SNOTZIEKTE.

Six cases occurred in the Umvuma area.

MYIASIS (SCREW WORM IN CATTLE).

This is prevalent in several districts.

IMPORTATIONS.

From the Union of South Africa: Cows 2, horses 23, sheep 1,357, goats 10.

EXPORTATIONS.

Nil.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA WEATHER BUREAU.

JUNE, 1932.

Pressure.—The barometric pressure was above normal over most of the country, but was slightly below normal at Salisbury. There were a number of lows on the south coast during the month. Two were very deep and moved up the south-east coast. The highs all appeared on the west coast and travelled overland, bringing dry air to Southern Rhodesia.

Temperature.—The month was cool, and a good deal of frost was recorded.

Rainfall.—Owing to the extremely dry winds accompanying the high pressure systems, there was no rain except on the eastern border, where very slight rain fell on two days.

JUNE, 1932.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen ° F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet).
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal.	No. of Days.	
Bulawayo ...	873.5	872.9	72	33	68.3	41.0	54.7	57.3	55.8	47.3	52	38	1.4	...	0.3	...	4,436
Gwelo	867.0	...	72	31	67.9	40.9	54.4	57.1	54.3	47.2	58	40	1.4	...	...	...	4,632
Riverbank ...	...	...	79	32	73 6	41.7	57.7	59.3	51.9	45.5	60	38	...	...	...	...	4,100
Essexvale ...	...	...	83	31	77.5	37.9	57.7	58.2	44.6	41.4	76	38	..	...	...	...	3,828
Gwanda ...	912.1	...	77	32	72.2	40.4	56.3	...	56.4	48.8	57	42	1.0	...	0.1	..	3,235
Mazunga ...	954.5	954.6	83	33	77.8	42.8	60.3	62.2	59.2	52.2	62	47	2.3	...	...	...	1,970
Nuanetsi ...	...	...	83	34	77.5	42.0	59 8	...	57.8	51.2	63	45	2.1	...	0.1	...	1,630
Between Rivers	...	...	76	32	73.3	39.0	56.2	...	53.1	47.7	67	43	2.1	...	...	...	3,970
Enkeldoorn ...	...	...	72	35	68.0	42.1	55.1	57.4	56.0	49.1	60	43	2.2	...	...	...	4,720
Gatooma ...	...	...	76	35	72.9	40.8	56 9	60.0	56.9	49.3	57	42	2.2	...	...	...	3,850
Miami	...	...	75	41	70.6	45.6	58 1	...	57.4	51.0	64	46	1.9	...	...	...	4,090
Salisbury ...	859.2	859.3	73	37	69.3	43.0	56.2	57.1	56.9	49.0	56	42	2.9	...	...	...	4,890
Sinoia, Citrus ...	...	...	77	34	73.5	41.7	57 6	...	55.5	48.8	61	43	...	...	...	...	3,830
Sipolilo... ...	...	...	75	40	70 3	45.5	57.9	...	58.9	51.1	61	42	2.7	...	...	...	3,900
Mtoko	...	...	78	43	66.4	48.6	57.5	...	57.4	50.8	63	45	2.8	...	...	...	4,210
Shamva ...	...	...	80	36	74.0	43.0	58.5	...	56.1	50.3	67	45	...	...	...	...	3,170
Angus Ranch ...	...	...	80	41	74.5	48.2	61.4	61.6	55.5	50.7	71	47	...	...	0.1	...	2,300
Craigendoran ...	...	...	80	34	75.1	44.0	59.6	...	59.4	53.5	68	49	...	...	0.1	...	3,430
New Year's Gift	...	...	80	41	73.4	48.2	60.8	...	57.0	51.3	67	47	...	...	0.2	...	2,700
Nyamasanga ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5,680
Riverdene North	...	...	77	27	72.2	34.1	53.2	...	43.3	41.2	84	39	...	...	0.2	...	3,700
Stapleford ...	...	...	66	29	59.7	36.4	48.1	...	51.8	48.1	82	47	3.9	0.10	0.6	2	5,450
Umtali	898.2	897.2	78	39	69.3	46.6	58.0	59 9	59.1	53 4	69	49	2.7	0.03	0.2	2	3,677
Victoria ...	...	...	75	31	70.2	38.4	54.3	55.7	53.2	46.9	62	41	1.5	...	0.1	...	3,570
Melsetter ...	854.6	...	70	39	64.4	44.7	54.6	...	55.9	49.8	65	44	1.2	0.09	0.6	2	5,060
Mount Selinda	...	...	74	43	67.3	47.3	57.3	...	59.5	54.0	70	49	2.0	...	0.6	...	3,520
Manchester ...	...	...	68	37	61.3	41.7	51.5	...	46.7	43.9	80	41	...	0.06	...	1	...

DEPARTMENTAL BULLETINS.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.

No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.

No. 429. Propagation of Kudzu Vine, by H. C. Arnold.

No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.

No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.

No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy. Dip.Agric., F.L.S.

No. 550. Onion Growing under Irrigation, by C. Mainwaring.

No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.

No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.

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No. 630. The Storage of Seed Potatoes, by H. C. Arnold.

No. 634. Barley, by P. V. Samuels.

No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.

No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

No. 651. Two Important Leguminous Crops : The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.

No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.

No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.

No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.

No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.

No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.

No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.

No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.

No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.

No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

No. 759. Witch Weed (Striga Lutea): Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.

No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.

No. 781. Agricultural Costings at the Gwebi Farm—Maize and Green Manuring, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

No. 787. Agricultural Costings at the Gwebi Farm—Ground Nuts and Maize and Beans for Silage, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 793. Agricultural Costings on the Gwebi Farm, by H. G. Mundy, Dip.Agric., Chief Agriculturist.

No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.

No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.

No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.

No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.

No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.

No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.

No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.

No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.

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EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Export of Chilled Beef from the Union.—During the last two months several small shipments of chilled beef have been sent by the Imperial Cold Storage from Capetown to Smithfield with satisfactory results.

On the whole the meat has met with an excellent reception, and though critics are not unanimous in their praises, their criticisms have been considerably less severe than was expected.

The cattle sent do not represent any "super prime" sample, and came either from Departmental sources at Pretoria or from Bechuanaland. The beef realised from 4¼d. to 4½d. sterling per lb. for sides, which is equivalent to about 3.33d. Union currency. These prices averaged about ½d. per lb. below those paid for ordinary Argentine chilled beef at the time of sale.

The expenses of shipment (including slaughter, freight, marketing, etc.) came to 1.16d. per lb. Union currency from

Capetown and 1.37d. Union currency from Johannesburg. From these expenses should be deducted a credit for offal of 0.34d. per lb. in Capetown and 0.25d. per lb. in Johannesburg. The nett return to the producer in Union currency was approximately 21s. per 100 lbs. dead weight in Capetown and 18s. 6d. in Johannesburg.

The condition of the meat was excellent, but it was faulted severely on account of the butchering, which, though an improvement was shown in later consignments, was not up to Smithfield standard. The cattle were criticised on account of age—resulting in "stagginess"—and lack of quality, but on the whole were considered suitable for the market.

The shipments are considered by the Union Department of Agriculture to be an unqualified success, and it is hoped that they will prove the precursors of a regular trade in chilled beef.

These reports should be of great value to Rhodesian cattlemen. Similar if not better cattle are available in Southern Rhodesia, and though the cost figures are not directly applicable to this Colony, when allowance is made for the heavier freight charges, etc., from this Colony to Great Britain, the final results on a sterling basis would probably be rather similar for cattle slaughtered in Bulawayo.

The detailed costs of the first shipment of frozen beef from this Colony through Beira, which should be available shortly, will be of great interest for comparative purposes.

World's Grain Exhibition: Canada.—24th July to 5th August, 1933, are the new dates set for the World's Grain Exhibition and Conference, to be held at Regina, Canada. This Exhibition is open to world-wide competition, and any grower in any part of the world may be an exhibitor.

A class of particular interest to Rhodesian growers is the 10 Ears of Dent Maize. The awards in this class range from 1,500 dollars first prize, 1,000 dollars second prize, 650 dollars third prize to 25 dollars fifth prize. Up to date over 40 countries, provinces and states have declared their intention to take some part in the World's Grain Show. Approxi-

mately 200 exhibits for the competitive classes are assured from Australia, and the prospects are that this number will be materially increased.

It is sincerely hoped that our prominent maize growers will seize this golden opportunity of advertising their maize and obtain an outlet for their pedigree seed, and also represent this Colony at the World's Grain Show. All entries must be in the hands of the Secretary of the Show on or before the 1st March, 1933.

Arrangements have been made by this Department to receive and take charge of any exhibits entered by growers in Southern Rhodesia.

The entrance fee in the 10 ear dent class is five dollars or its equivalent in other currency plus transportation charges.

Tsetse Fly: Eastern Border.—For many years a number of farms on the Eastern Border have suffered losses of stock from trypanosomiasis. These losses have increased considerably during the past few years, several farms have been evacuated and the development of one of the finest districts in Rhodesia has in consequence been greatly retarded.

The problem has been investigated by members of the Entomological Branch on several occasions, and a very comprehensive report was received some years ago from Mr. C. F. M. Swynnerton, now Director of Tsetse Research in Tanganyika Territory, whose knowledge of the district and its flora and fauna is probably unexcelled. For many years it was considered that little could be done in Rhodesian territory to alleviate the position. The main "fly" belt is situated across the border in Portuguese Territory. This portion of the International Border runs along an elevated crest of land ranging in altitude from approximately 6,000 feet at Melsetter to 3,500 feet at Mount Selinda. On the eastern side the land falls away sharply, very much in the nature of an escarpment, into Portuguese East Africa, with an altitude of roughly 1,500 feet. A number of rivers penetrate the border, notably the Lusitu River, the Buzi River and the Umselezwe River, their courses lying in deep and

usually well-wooded valleys forming a more or less well defined forest connection with the "fly"-infested forest of Portuguese East Africa. Much of the elevated border consists of open grass land with some open forest and isolated patches of denser forest along the streams. Occasional patches of high type rain forest occur on some of the hills. Within recent years a natural increase in the forest has been noticed, due possibly to the combined effects of under-grazing and protection from veld fires.

Two species of tsetse flies are known to exist in Portuguese Territory close to our border, viz., *Glossina brevipalpis*, crepuscular in habit and restricted in range to a close forest giving much shade, and *Glossina pallidipes*, a thicket-loving fly, but much less restricted in its range of forest types than *brevipalpis*. Both these flies are carriers of the trypanosomes which cause animal trypanosomiasis or "nagana" in domestic stock. A third species of tsetse fly, *G. morsitans*, the species which occurs in the main "fly" belts in Southern Rhodesia, is known to occur east of the Sitatonga Hills in Portuguese East Africa, but its presence near our border has not been confirmed. The first two mentioned flies possibly require a more humid environment, or an atmosphere with a lower degree of saturation deficiency than does *morsitans*, which is a savannah forest fly and highly zerophytic.

Climatically, the Eastern Border with its high rainfall and mist-belt characteristics is possibly unsuited to *morsitans*, but the conditions along the low-lying valleys within our border are in many respects typical of the conditions, both climatical and ecological, which occur in the main "fly" belts in Portuguese East Africa.

Although the losses from trypanosomiasis on many of these border farms have been severe, only one tsetse fly (*G. pallidipes*) has ever been taken on the Rhodesian side of the border. This fly was caught on his horse by the local cattle inspector on Mount Selinda within a mile of the border.

It is probable that natural cyclical transmission of the disease by ranging tsetse flies occurs fairly frequently, although the flies have not been seen. Mechanical transmission of the disease from an infected animal to a healthy one by other species of biting flies may also occur. Under

the favourable climatic conditions which prevail, this latter mode of infection may take place comparatively frequently, in view of the methods of herding employed and of the large number of biting flies that exist in this district at certain seasons of the year.

Evidence proving conclusively that tsetse flies do range into Southern Rhodesia along the natural forest connections with Portuguese East Africa does not exist. It is reasonable, however, to assume that they do, investigations in other parts of Africa having shown that *pallidipes* is a wide ranging species.

To what extent pedestrian traffic or wandering game may be an additional complicating factor is not known, though small herds of buffalo are fairly frequent visitors to some of the border farms.

Forest Clearings, Melsetter Border.—As a result of a recent investigation undertaken by the Chief Entomologist and the Senior Forest Officer in this area, certain localised experimental forest clearings have been authorised. Two areas are to be cleared of forest, one approximately 250 acres in extent, on the Buzi River, intended to break the forest connection in the Buzi Valley with the forest in Portuguese East Africa, and the other, an area of about 200 acres on the Chibudzana River, a tributary of the Buzi River, necessitated owing to a continuous bush connection across Bayswater Farm with Portuguese East Africa. In both cases about 1½ miles of bush in the river valleys will be cleared. Certain small subsidiary clearings will also be undertaken. Complete clearing of the forest on all the farms where trypanosomiasis has occurred is not contemplated, primarily on the score of expense, and, secondly, on the assumption that if the forest connection is broken the free ranging of tsetse flies into Rhodesia will be stopped. Naturally any additional clearing which individual owners might undertake at their own expense would assist in rendering their farms unsuitable for the "fly," and would, therefore, be an additional safeguard for their stock. Such clearings have, in fact, been recommended by this Department for many years.

Considerable information exists both from local experience and from the work being carried out in Tanganyika Territory and Nigeria as to the cheapest and most effective form of clearing to undertake. In the present experimental clearings the bush will be felled and piled around the stumps. Later in the year, as soon as the felled timber is dry enough, the cleared area will be burnt. This method, it is anticipated, will kill most species of trees which occur in the area. Some species of indigenous forest trees are, however, extremely difficult to kill in this way, and a certain amount of coppicing from root suckers is almost inevitable. It is hoped that by judiciously timed regular burning this annual growth can be kept down. A fairly large native population resides in the areas to be cleared, or can be induced to occupy them, and their presence will assist in maintaining the clearings. For the present, the cleared areas will not be fenced, but the grazing of stock will be regulated.

For various reasons it is not considered that permanent "fly" has as yet become established in this portion of Southern Rhodesia. Even though these clearings, designed primarily to protect the farms lying in the area drained by the Buzi River and its tributaries, are of an experimental nature, the result is looked forward to with some confidence.

A careful reconnaissance of the tsetse fly position along the eastern border will be undertaken concurrently with these clearing operations. These investigations should throw some light upon the prevalence of "fly" and the species of "fly" occurring in Portuguese territory close to the border and may indicate other unsuspected channels along which "fly" may range into Southern Rhodesia.

A general census of the cattle on the affected farms is also being taken in order to keep a check on the incidence of the disease.

African Aloes.—About eighteen months ago we were fortunate in securing a series of articles on "Making a Garden in Southern Rhodesia" by Mrs. E. M. V. Carnegie. These were later assembled into a reprint, which has met a large demand. We are pleased to be able to supplement

this series by "Notes on African Aloes," by Mr. H. Basil Christian, the first part of which appears in this issue.

As is generally known, the aloes are, with the exception of possibly one species found in China, entirely African, and probably eighty per cent. of the total number of different kinds are found in South Africa.

In this Colony some fifteen to twenty species probably occur, and it is quite possible that some of them are still in the category known as new species, i.e., undescribed and unnamed. We believe the most complete private collection of African aloes in existence is that of Mr. Christian, and it is owing to the rapidly increasing interest which is being taken in the interesting and fascinating hobby of collecting and growing African aloes and other succulent plants that he has undertaken to provide this series of notes and illustrations of the more common varieties.

Empire Marketing Board Report, 1932.—The change which has taken place in the buying habits of the British public and the growth of the demand for Empire goods are clearly brought out in the Annual Report of the Empire Marketing Board recently published. For twenty-five Empire products new records in quantities of imports have been established, and for more than half of these the record now surpassed was made in the previous year. There is an upward tendency at work in spite of the diminished buying power of the public.

Scientific Research.—As in previous years the bulk of the Board's income has been devoted to scientific research. Some 70 out of the 100 pages of the Report describe the immensely varied field of research which the Board's funds have helped to irrigate. The Imperial Conference of 1930 urged the value of joint programmes of scientific work which should be agreed upon between the various Empire countries so that effort and expense might be concentrated and economised. Acting upon this suggestion, the Board has initiated an interchange of views on what problems of economic importance to the Empire most urgently need the further application of scientific research.

It has been the Board's practice, since the foundation in 1926, to make grants for a term of years to existing institutions in conjunction with other bodies. This method has worked admirably, but it makes discontinuance difficult. To stop research that is under way is commonly to sacrifice money already spent and work already done. In the interest of national economy the Board is making at present scarcely any fresh grants, and it has succeeded, with the co-operation of the institutions concerned, in reducing its present commitments by between 10 and 25 per cent. Similar economies in publicity and marketing work enabled the Board to meet the call made upon it by the Treasury last summer for the surrender of £110,000 from its total vote of £550,000. For the present year, 1932-33, the vote of the Board is £300,000.

The Locust Plague.—To combat the grave locust menace in tropical Africa the Marketing Board has joined forces with the territories principally affected. Two locust investigators are now in Africa tracking down the breeding places of the locust swarms, and the Imperial Institute of Entomology in London has been recognised by France and Italy as the international intelligence centre from which the war against the locust in Africa is to be planned by scientists.

Tobacco Culture, Umvukwes.—Although contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are regularly invited, it is very seldom that farmers are prepared to describe their own personal experiences for the information of others interested in the same subjects.

The article on the "Fertilising and Topping of Tobacco," by Mr. L. Worthington-Smith, of Pembi Falls, Umvukwes, which is printed in this issue, is therefore greatly appreciated.

We are confident that this will be read with interest by all tobacco growers.

It is well known that the results of experiments are apt to differ with varying conditions of soil and climate, but the results obtained at Pembi Falls are considered to be of fundamental importance in regard to tobacco culture in this Colony. It is hoped, therefore, that tobacco growers whose

experiences vary from those reported will supply details for publication, as it is recognised that flue-cured tobacco must be for many years to come one of the main sources of income on the lighter soils of the Colony.

African Coast Fever, Melsetter District.—Owing to the repeated recurrence of African Coast Fever in the Melsetter and Chipinga districts, a Departmental Committee was appointed to enquire into the position in detail. The committee consisted of Mr. A. C. Bagshawe (in the chair), the Director of Agriculture, Mr. L. Glanfield (Ballineety Farm, Salisbury) and Mr. A. L. Millar (Estes Park, Salisbury).

Evidence was taken at Melsetter on the 15th and 16th August, and at Chipinga on the 17th.

The Veterinary Department was represented by the Chief Veterinary Surgeon, D.V.S. Coutts, D.V.S. Gordon, D.V.S. Adamson and the Cattle Inspectors at present stationed in the area.

About twenty witnesses gave evidence before the committee, and the report containing the findings of the committee is now being prepared.

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

FURTHER NOTES ON LEAF CURL OF TOBACCO IN SOUTHERN RHODESIA.

By J. C. F. Hopkins, B.Sc.(Lond.), A.I.C.T.A.
Government Plant Pathologist.

In the March issue of this Journal (1) Dr. Storey, of the East African Agricultural Experiment Station, Amani, published his report upon a tobacco disease which he had been invited to investigate. He stated that he considered it to be identical with the leaf curl, which he had recently described from Tanganyika (2), and which he had demonstrated to be transmitted from plant to plant by an insect known as white fly (Aleurodidæ). Since Dr. Storey's departure from Southern Rhodesia, successful transmission of leaf curl from diseased to healthy tobacco has been accomplished at the Plant Pathology Laboratory through the agency of a species of white fly, and it now remains to give an account of the position as it stands to-day with regard to the disease.

Until Storey published his first paper on leaf curl in August, 1931, the cause of the disease was unknown to science, although the presence of a virus had for some time been suspected in Rhodesia (3) and Nyasaland* and probably elsewhere. Roberts (4) claimed to have produced the disease by transferring small brown capsid bugs (*Engytatus volucer*, Kirk.) from diseased tobacco and feeding them upon healthy plants, but he attributed the curling to a physiological disturbance in the plant caused by excretions from the salivary glands of the insects. Repetitions of this work in Rhodesia, using plants in insect-proof cages, have yielded negative results which have also been obtained by other workers (2), (5). Other methods of transmission had been attempted by the writer during the past five years, but

* Private communication.

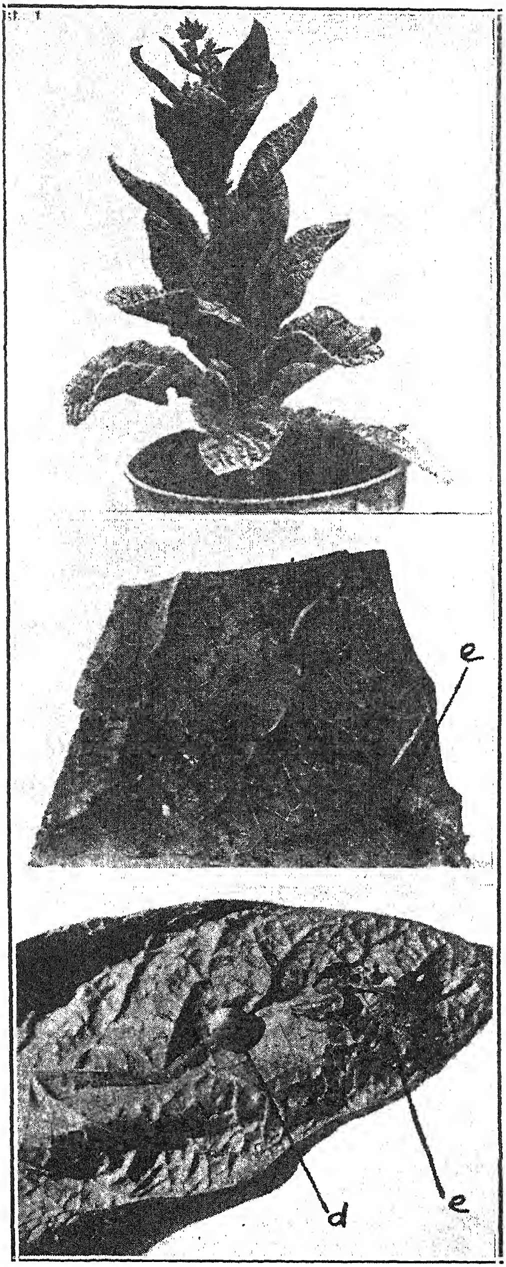

Fig. 1.—Tobacco plant artificially infected with leaf curl by the use of virus-carrying white flies.

Fig. 2.—Vein thickenings (*enations*) as they appear when leaf is held up to the sun. (*e*) Large leafy outgrowth on underside of leaf.

Fig. 3.—Thickenings and growths from lower side of veins, as seen by reflected light. (*e*) Very large enations. (*d*) Drawing pin.

always without success. No serious outbreak in the field had been witnessed, so that the possibility of a dangerous epidemic of leaf curl was considered to be somewhat remote, especially as a few diseased plants could be found in almost any tobacco field. They were, in the great majority of instances, associated with shallow soil and a poorly developed root system, so that the disease was not regarded as being infectious. Each year, however, some investigation was made into the cause of the disease and upon the appearance of Storey's paper recording his experiments, an exchange of photographs was made with that author. It was still uncertain whether the Amani disease was identical with that which I had called "Crinkling" (and which was generally known amongst Rhodesian farmers as "Frenching") owing to the wide variability in symptoms produced by the disease. It was not until Storey visited the Colony that a more definite decision could be arrived at.

In the meantime, reports of serious outbreaks of "Crinkling" were received from several parts of the Colony, and many of the specimens submitted could, by comparison with Storey's photographs, be diagnosed as the Amani disease. Furthermore, white flies were found in abundance on some of the material, but the tobacco aphis (*Myzus persicæ*) and the brown capsid bug (*Engytatus volucer*) were also present and might have been responsible for the curling of those leaves which did not show the typical vein-thickening, regarded by Storey as the only reliable diagnostic character of leaf curl.

A number of tobacco plants, which had been raised from seed under insect-proof conditions, were fortunately available at the time, so that it was possible to start infection experiments with adult insects, raised from the original diseased tobacco by the Entomological Branch of this department. The number of infected insects obtained was small, and as the only available plants were nearly half-grown, the method of infection used was to place five or six insects in a glass tube, 6 inches long by 1 inch in diameter, one orifice of which was closed with cotton wool and the other pressed gently against the under side of a leaf. The glass tube was fixed vertically in a clamp and the leaf was held in position by a pad of cotton wool which was lightly clamped to the upper surface above the mouth of the tube. White flies, aphids

and capsid bugs were used as vectors, but no infection had occurred after a period of one month. All insects were observed to feed upon the leaves. Some of the white flies lived as long as fourteen days, but were not observed to breed in the tubes. The experiment was repeated with a larger number of plants and flies with the same result. Mechanical transmission with infected juice, which had been passed through a porcelain filter (L 3 Chamberland), and was injected into leaves and stems by a hypodermic syringe or was applied to needle pricks on leaves and stems, also gave negative results. If then, it is conceded that leaf curl is due to a virus which is transmitted by white flies, then either the Rhodesian disease was not leaf curl or else our experimental technique was at fault.*

If the latter alternative were true, then one useful fact had been learned from the experiments, namely, that the length of life of the infected adult white fly was about fourteen days. In making recommendations to cope with further early outbreaks of leaf curl, this fact was used as the basis for the formulation of emergency control measures, the remainder being founded upon hypothesis. It was argued this way. If, as there was good reason to suppose, the Rhodesian disease were identical with Storey's leaf curl (although another virus disease might also be present), then the sudden outbreaks of 100 per cent. leaf curl in the early plantings could only be accounted for by the presence of an abundance of *infected* white fly in the lands, and infection must have been obtained from some source close at hand, the most likely being diseased volunteer plants. The obvious line of investigation was therefore to seek these, and a short search brought to light some of the previous year's plants, which had missed the plough and had produced "suckers"

* The reason for the failure of these experiments is not quite clear, because the insects were observed to feed upon the leaf for a period of 12 to 14 days. Two possible explanations present themselves—namely (1) the percentage of infected insects obtained from a leaf curl plant is very small, so that the chances of transmitting the disease with a small number of flies is remote, or (2) the rim if the glass tube, pressing against the underside of the leaf, so injured the cells that the virus was unable to diffuse beyond the enclosed circular area.

The former explanation is improbable, because two or three tubes, containing in all 15 to 20 white flies, were placed upon some of the plants in the second unsuccessful experiment. The wounding hypothesis seems more likely, since several areas of leaf enclosed within the rims of the glass tubes became chlorotic and wilted after five or six days.

showing typical symptoms of leaf curl. White flies were present in hundreds and were breeding freely on all suckers. It was now clear that if all infected plants could be removed from the vicinity of the lands and the white flies killed out, then there would be a good chance of new plantings remaining free from the disease. This is where knowledge of the length of life of the adult fly was urgently required, for if all tobacco were removed and destroyed, then the infected immature stages of the insect upon the plants would also be destroyed, and the adult flies would in time die off without producing an infected succeeding generation. If they did breed, which was unlikely, then they would in all probability do so upon plants which were not susceptible to leaf curl. It was therefore necessary to know how long the lands were required to be kept fallow before re-planting could be carried out with safety, and, as the season was already well advanced, the minimum period of safety was an important factor. After taking into account a number of considerations, it was eventually decided to allow three weeks to elapse after the last tobacco had been destroyed before new seedlings were to be planted out. This period of time appears to have been adequate because very little infection appeared in the second plantings.

The position, then, when Storey arrived was that there appeared to be two similar virus diseases of tobacco in Rhodesia, one closely resembling his leaf curl and associated with the presence of white flies and another which I called "Crinkling" (but was popularly known as "Frenching," which is a distinct disease), the cause of which was not definitely determined. The former had appeared in epidemic form in several parts of the Colony, the latter appeared to be unimportant economically. Infection experiments using white flies, aphids and brown capsid bugs had yielded negative results, but field control recommendations based upon Storey's results at Amani were apparently turning out successfully.

The position as it actually is has been made clear by Storey in his report (1) and is confirmed by the following work.

Young tobacco seedlings, which had been raised from seed under insect-proof conditions, were potted out in rich

soil, one plant to a pot, in the previously fumigated, screened glass-house, the hands of the operator being washed between each planting. The seedlings were then covered by Dietz lamp glasses, the open tops of which had been closed by fine muslin. Three days later white flies obtained from leaf curl tobacco plants were introduced into the lamp glasses, 25 flies to each plant. Six plants received flies collected in Salisbury and four plants were infested with insects from Mtepatepa district. Ten plants were grown under lamp glasses without white flies and served as controls. As Storey had experienced difficulty in inducing the insects to leave the tops of the lamp glasses and feed upon the seedlings, it was decided to cover the glasses with brown paper bags, leaving a small orifice at the base where light could enter. After 24 hours the bags were removed and flies were observed to be feeding on all plants.

A week later the pots were taken from the glass-house and the lamp glasses removed. The seedlings were then washed thoroughly with 1-250 nicotine and soft soap solution and replaced in the glass-house, which had again been fumigated. Control plants were similarly treated.

Two weeks later some of the infected plants showed clearing of the veins of the leaves and slight curling of the midribs and leaf blades. Within three weeks eight out of the ten treated plants showed typical symptoms of leaf curl, including curling of leaves, thickening of veins and large leafy outgrowths (*enations*) from the lower sides of the veins. All plants were kept under insect-proof conditions for some weeks, after which time the eight treated plants had produced flower heads, and exhibited the same symptoms as are commonly encountered in Rhodesian tobacco fields. All control plants remained healthy.

The appearance of experimentally produced leaf curl in Orinoco White Stem tobacco is shown in Fig. 1. The typical thickening of veins, as seen by transmitted light, is shown in Fig. 2, in the bottom right-hand corner of which can be seen a large leafy outgrowth (*enation*). Fig. 3 shows exceptionally large enations on an old leaf.

It will therefore be seen that leaf curl of tobacco in Rhodesia appears to be identical with that occurring in Tanganyika, being due to a virus which is transmitted from

plant to plant by an insect known as white fly, but is not transmissible mechanically on the hands of labourers. The control measures, which have already been recommended and are fully detailed in Storey's report (1), are the best that can at present be formulated, so that the tobacco grower must realise at once that the prevention of further development of the disease in the Colony rests mainly with himself.

The important fact to remember is that the uninfected white fly by itself is harmless; it is only the infected insect which can produce leaf curl in healthy tobacco. If all sources of infection are removed immediately after reaping is completed, then there will be no reservoir for the flies to feed upon at the beginning of the following season, and the disease is unlikely to make its appearance. All old stalks should therefore be uprooted and destroyed and a diligent search made for volunteer plants in old lands, near grading sheds and offices, and in the native compound. No plant should be allowed to remain growing in odd crevices and corners of buildings, as so often happens, for a great number of these will be found on examination to be infected by leaf curl. Similarly, diseased plants which appear in the lands should be removed at once in order to prevent the establishment of a seat of infection for the remainder of the crop.

All growers are asked to co-operate in the eradication of leaf curl, for it is quite possible that the disease, if allowed to spread unchecked, will become a menace to the whole tobacco industry of the Colony.

Investigations are still proceeding at the Agricultural Laboratories, Salisbury, into a number of problems connected with leaf curl. The life history and hibernation habits of the white fly are being studied by the Entomology Branch, whilst the question of alternate host plants is engaging the attention of both Plant Pathology and Botany Branches. Already a wild, shrubby species of *Vernonia* is suspected of harbouring the disease. White flies obtained from this plant and placed upon tobacco did not, however, transmit leaf curl, but the number of flies obtained was very small, and previous experiments have shown that about 25 is the minimum number required per plant in order to obtain a high percentage of successful transmission. Further experiments are being planned.

Preliminary selection of resistant varieties has kindly been undertaken by Dr. Storey, whilst seed is being kept from an artificially infected plant in Salisbury, which developed only mild symptoms of the disease.

It is hoped that a fuller knowledge of the habits of the insect vector and the host range of the virus may put the Department into the position of being able to evolve control measures as equally successful as those recommended for the control of mosaic.

My thanks are due to Dr. Storey for arranging the successful transmission experiment described above and for fully demonstrating his technique.

SUMMARY.

1. An account is given of preliminary investigations into the nature of leaf curl disease of tobacco, and the position as it stood before Dr. Storey's visit last January.
2. Successful experiments in the transmission of the disease by the agency of white flies (*Aleurodidæ*) are described.
3. Recommendations are given for the control of the disease.
4. Further research is being undertaken in connection with the life-history of white flies and the presence of alternate wild host plants.

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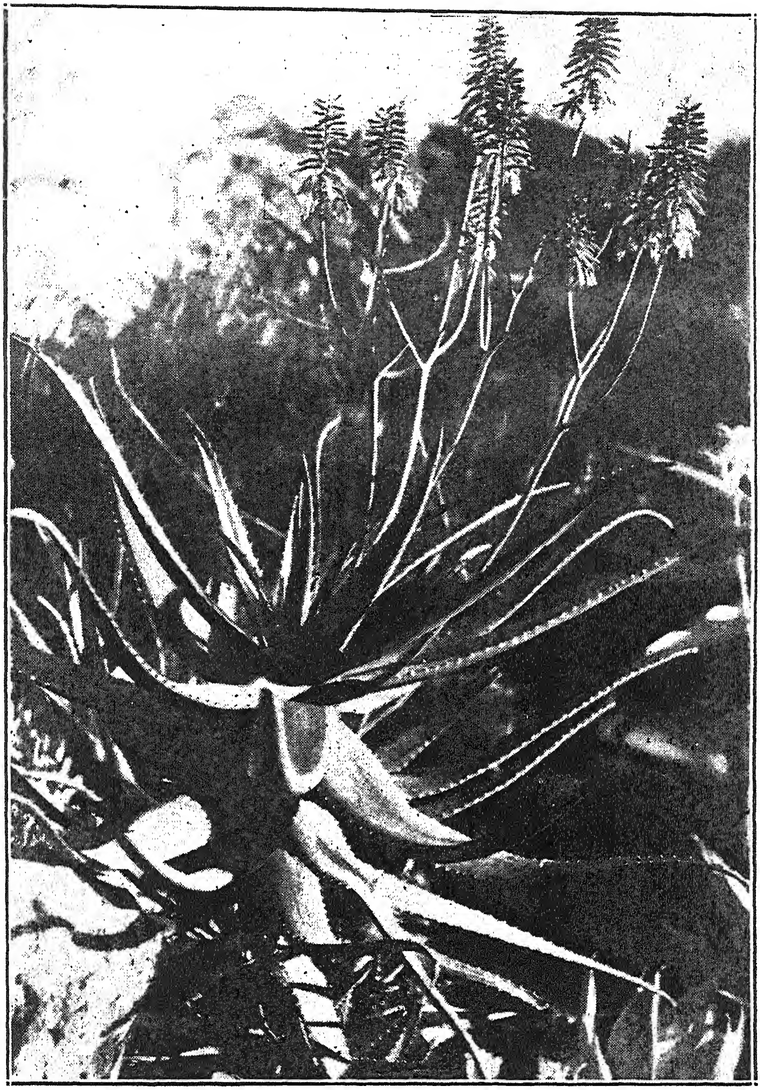
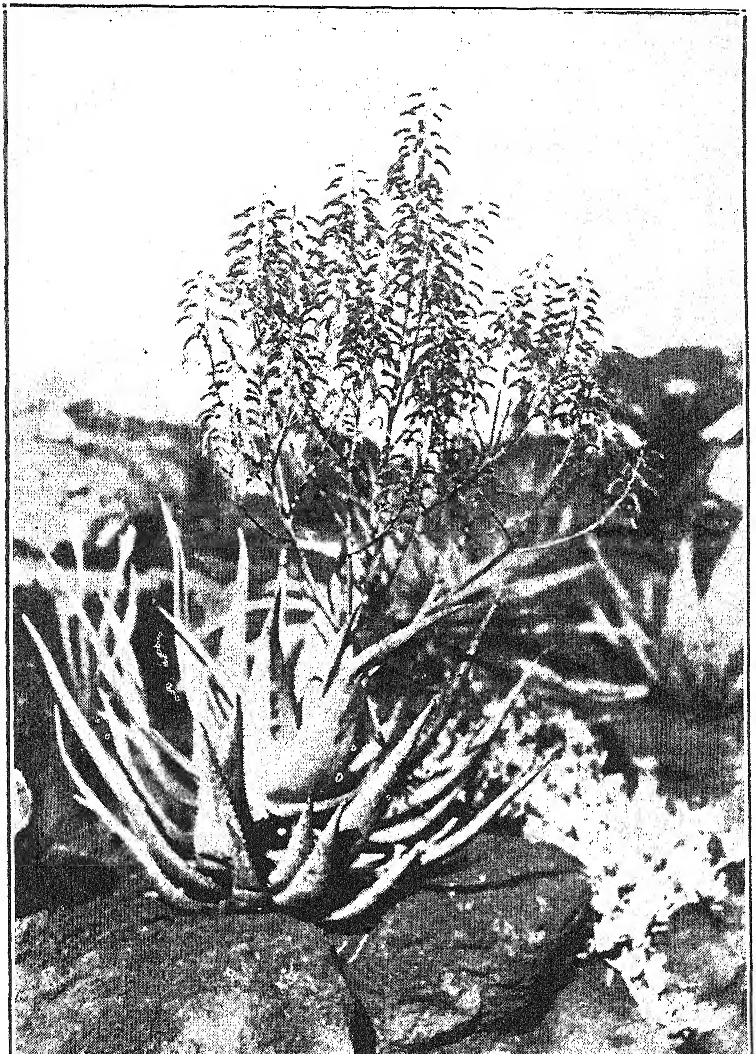
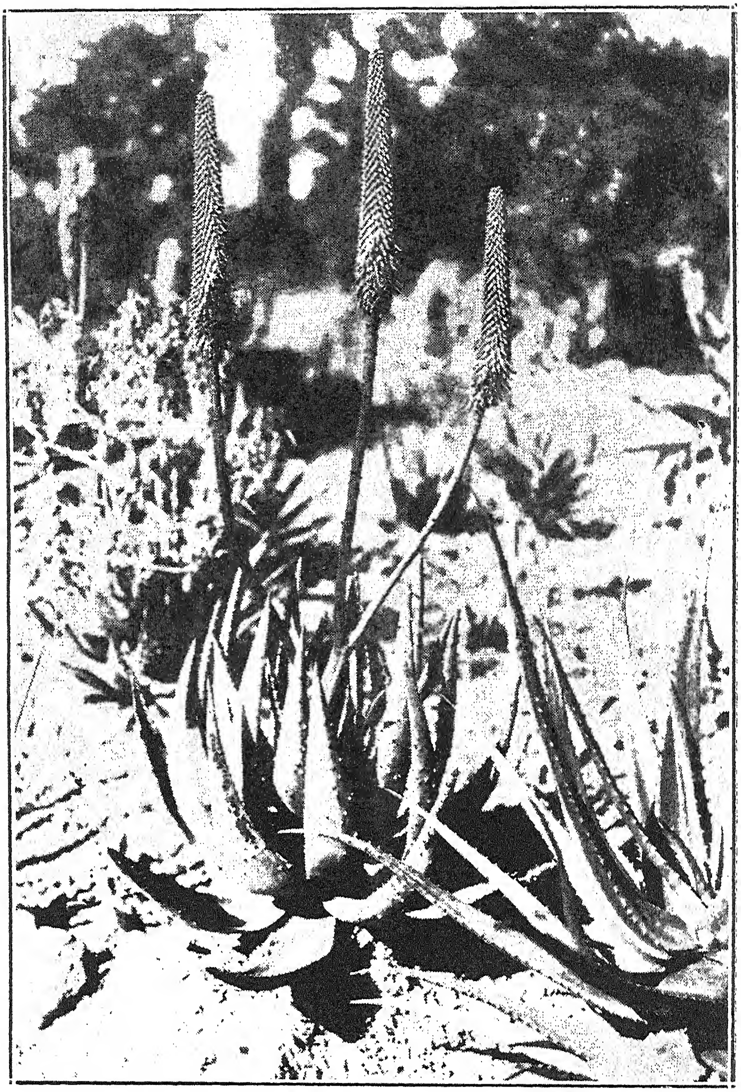


A. Hildebrandtii (common variety).



A. chabaudii.



A. aculeata.

NOTES ON AFRICAN ALOES.

By H. Basil Christian, Ewanrigg, Arcturus.

PART I.

From a gardening point of view the growing of aloes has several advantages which are not possessed by the ordinary plants grown for decorative purposes. Aloes are perennials, and once they are planted they continue growing and flowering for many years. Once established, they can persist throughout the driest seasons without watering, although certain species from the winter rainfall areas or mist belts thrive much better with an occasional watering in our winter.

Aloes transplant very easily—even the biggest plants—and the drier they are at the time, the better. The leaves are then less brittle and not so liable to break off, and they weigh much less.

It is not necessary to try to preserve the roots; it is better to cut these right back. Aloes having stems need not necessarily be dug out by the roots. If sawn or cut off and the upper portion bearing the leaves planted, they will grow. Most species can remain out of the ground for a considerable time before being replanted without suffering any permanent damage.

Certain aloes have the habit of throwing out suckers from the base in the case of acaulescent or stemless species, or from the stem in the case of arborescent aloes, or species having stems. Certain other acaulescent plants throw out underground runners which produce plants at a distance from the parent plant. All these suckers, if cut off and planted, will grow readily, so that it is possible to increase one's stock of plants rapidly and cheaply.

The principal flowering time in Southern Rhodesia for most aloes is from May to August, a time when, to get a

show of ordinary flowers, constant watering is necessary, but there is hardly a month in the year when there is not at least one species in flower.

Growing aloes from seed is an interesting sideline, as they hybridise freely, and in an aloe garden where many different species are grown, there is likely to be a certain amount of cross-fertilisation, and, as often as not, a certain number of hybrids will make their appearance. Often these hybrids are more beautiful than the parents, and, in my experience, are generally more vigorous.

Most aloes improve under cultivation, but, on the other hand, there are certain species that are difficult to grow, or, if one succeeds in growing them, to induce to flower away from their natural habitat. To a really keen gardener this adds greatly to the interest of growing them, and if one has a bit of luck and succeeds where others have failed, well, the others don't feel as one does!

There are certain diseases and pests which attack aloes.

White Scale.—This appears on the leaves and can easily be cured by the mechanical action of washing with soft soap and water, preferably warm.

Rust.—This first shows in circular patches on the leaves, and can completely kill the plant. The Government Mycologist recommends dusting with sulphur.

Certain species of weevils bore into the plant, deposit their eggs and later on white grubs hatch out, which eat into the heart of the plant and may kill it if not taken in time. If noticed in time, the grub can be picked out with a knife, and little permanent damage is done to the plant. The moment one notices the small young leaves in the crown of the plant showing signs of rotting, get busy with the knife.

Dr. Pole Evans, Chief of the Division of Botany in the Union, says that at the Union Buildings, Pretoria, where they have the largest and most complete collection of aloes in the world, the practice is to spray with a solution of concentrated tobacco juice and arsenate of lead after the first rain and thereafter once a month. This is as a preventive, and has not been a complete success with me.

Another remedy I have recently heard of from a keen collector is to pour a few drops of carbon bisulphide into the crown of the plant. It is claimed that unless the plant is too far gone, this treatment will save it.

Some species from the more arid regions suffer from the heavy rains in the wet season. The only precaution I can suggest, apart from covering with glass, is perfect drainage, and this does not always succeed.

There are a few botanical terms it will be necessary to use from time to time in the notes on the different species.

Acaulescent	Stemless
Caulescent	Having stems.
Arborescent	Tree-like, or having stems.
Peduncle	The flower-stem bearing the inflorescence.
Perianth	The tubular or bell-shaped part of the flower.
Perianth segments ...	The upper part of the perianth not connected into a tube.
Corolla tube	The lower part of the perianth.

Aloe Chaubaudii.—This is the commonest and most widely distributed of our Southern Rhodesian aloes. It ranges from the Victoria Falls and Umvukwes in the north, Matopos in the west to Melsetter in the east and Victoria in the south, and extends into the Northern Transvaal.

It is always found on or at the base of granite kopjes. I have not heard of it growing on our red soils.

It often, but not always, throws out suckers from its base.

It is an acaulescent plant with pale glaucous leaves about 18 ins. long, unspotted, with prickles on the margins but none on either face. The inflorescence is a loose panicle with ascending branches, and grows to a height of 2-3 ft. in its wild state. The flowers are pale brick red.

It flowers in June and July and into August.

There is a variety of this in the Matopos which is more densely flowered and is in flower some weeks earlier than the common variety.

A third variety which is rare and so far has only been recorded from the Victoria district has pure yellow flowers.

Aloe Hildebrandtii.—This aloe is widely distributed over Southern Rhodesia, extending from the Matopos to Umtali and from the Northern Umvukwes to Victoria, but is nowhere as common or plentiful as *A. chaubaudii.*

The leaves become copper colour in the winter. It flowers in June and July, and the colour of the flowers varies very considerably.

It is generally confined to granite kopjes, and generally suckers from base of stem.

It is an arborescent plant, with the stem up to 3-4 ft. high or more. The leaves are rich green, turning to copper colour in winter, unspotted, except in case of young plants, which may have a few oblong white spots towards the base of the leaves. There are prickles along the margins of the leaves, but not on either face; inflorescence one or several from same rosette of leaves; peduncle branched; flowers in rather lax racemes.

A variety with denser racemes, which are more cylindrical, red above and white or pale yellow below, occurs in the Umtali district, whence I have obtained the only pure canary-yellow specimen I have seen.

Aloe aculeata.—This also occurs in the Matopos, Bembesi, Enkeldoorn and Victoria districts, and is probably even more widely distributed. It also occurs in the Northern Transvaal.

It is stemless, or with a short stem up to 3 ft. high, and it flowers in July and August.

The leaves have prickles on the margins and on both surfaces. The peduncle is usually branched and grows to about 3 ft. high to the top of the inflorescence, the branches ending in dense racemes up to 12 inches long. The flowers are strongly reflexed, and when open the stamens and style project from the perianth.

There are at least two varieties of this aloe in Southern Rhodesia, unless the botanists decide that they are separate species. The variety illustrated has very few prickles on the

upper surface of the leaf, and the flower spike is dark orange in colour.

The other variety is very much more copiously studded with prickles on both surfaces of the leaf, and the raceme is red above and yellow below. It comes into flower earlier than the first variety.

(To be continued.)

SALES.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

Spineless Cactus Slabs (blades) Algerian variety, per 100 slabs, 7/6 Salisbury, or 12/6 delivered free by rail to purchaser's nearest station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Stocks are limited and delivery cannot be undertaken after 15th November.

Kudzu Vine Crowns, per 100 crowns, 15/-, Salisbury, or 25 crowns, 7/6; 50 crowns, 15/- and 100 crowns, 22/6, delivered free to purchaser's nearest station or siding in Southern Rhodesia. Delivery during September and October for irrigated land, and in January for dry land. Owing to pressure of other operations, it is not possible to deliver Kudzu crowns during November and December.

The prices quoted above do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

EFFECT OF APPLICATION OF LIME TO THE SOIL ON THE DRYING-OUT OF MAIZE.

By The Chemical Branch.

In a previous article published by this branch in the December, 1931, edition of the *Rhodesia Agricultural Journal*, attention was drawn to a statement by Blair, of the New Jersey Agricultural Experiment Station, who reported that the results of certain liming trials carried out in New Jersey indicate that liming of soils tends to give uniform ripening and drying of the corn, and that maize grown on acid soils does not mature and dry out quite so early as maize grown on soil containing a fair supply of lime.

As this is a matter of general interest to farmers in Southern Rhodesia, it was arranged with the Chief, Division of Plant Industry, for maize being grown on the Salisbury Experiment Station in liming experiments to be placed at our disposal for analysis during the drying-off season.

These liming experiments are being carried out on plots that have been under continuous cultivation for about 20 years and have never, during this period, been limed.

The soil on these plots was shown by analysis to be much more acid than the average soil on the Experiment Station, and, although the limed plots received lime at the rate of 1 ton to the acre, this was not sufficient to meet its lime requirements and hence the soil was still acid.

The method adopted was for 5 or 6 cobs to be taken from limed plots and unlimed plots at fortnightly intervals commencing at the beginning of May, and subjecting them immediately to analysis for their moisture content.

All the plots received a basal dressing consisting of 200 lbs. of superphosphate and 25 lbs. of muriate of potash

per acre before planting. The limed plots, in addition, received one ton of lime per acre. The following are the results obtained :—

Dates of sampling.	3.5.32.	17 5.32.	31.5.32.	14.6.32.	28.6.32.	13.7.32.
Plot with no lime . .	33.2	28.2	19.1	18.3	13.6	11.2
Plot with lime	29.1	26.7	22.6	18.4	12.3	11.8

Result.—From the above figures, it will be seen that the application of 1 ton of lime to the acre on a markedly acid soil exercised no beneficial influence on the drying-out of the maize.

Effect of Different Methods of Applying Fertilisers on the Drying-out of Maize.

At the request of the Manager, Salisbury Experiment Station, a number of tests were carried out on the moisture content of maize at fortnightly intervals from the beginning of May until the beginning of July in order to determine whether the method of applying fertiliser exercised any influence on the drying-out of the maize.

Observations made in the field by the Manager during previous years had led him to believe that maize grown in plots to which fertiliser had been applied direct in the holes dried out quicker than maize from plots where the fertiliser had been broadcasted. The treatment each plot received was 150 lbs. of superphosphate per acre at the time of planting.

Results of Analysis.

Dates of sampling.	10.5.32.	23.5.32.	7.6.32.	21.6.32.	5.7.32.
Plot with fertiliser broadcast	29.4	24.1	18.8	15.5	14.3
Plot with fertiliser put in holes . . .	30.6	23.6	19.7	14.6	14.1

Result.—Determinations of the moisture content of maize at fortnightly intervals during the drying off season gave no indication of any particular beneficial effect being derived from applying the fertiliser in the hills as against applying it broadcast.

CREAM CHEESE.

By F. A. Lammas, Dairy Officer.

The practice of soft cheese-making is not very common in this Colony, probably chiefly on account of adverse climatic conditions and long distances of transport.

As a general rule, soft cheese contains a high percentage of moisture, in consequence of which keeping qualities are seriously hampered, and manufacturers of this type of cheese have frequently found their produce to be of inferior quality before it has been marketed.

Cheese of the hard, pressed variety—such as Cheddar, for example—always finds a ready sale, for this type of cheese has become well known, has fairly good keeping qualities, and moreover is no longer looked upon as a "delicacy."

Soft cheese, however, does not enjoy the same popularity, and it is only amongst certain people that a demand is created.

That a market does exist for a limited amount of soft cheese, especially cream cheese, in this Colony is beyond a doubt: it remains only for the farmer or manufacturer to cultivate this taste for soft cheese in our larger towns and to capture and retain this waiting trade by keeping before the public a well-made and tastefully displayed article.

Requirements.—As in all branches of dairying, the manufacture of cream cheese calls for cleanliness and constant supervision, and it is the duty of the maker to attend to every branch of this business in person.

Cleanliness is essential, for as already stated cream cheese contains a high percentage of moisture, and unless the milk is produced under scrupulously clean conditions the final product will have poor keeping qualities.

Apparatus.—With the exception of a dairy thermometer and a small supply of liquid rennet, all the apparatus necessary—namely, enamel pails, linen or calico cloths—will be found amongst the usual household equipment.

If, however, the cheese is to be made on a large scale, it will be necessary to obtain proper moulds, straw mats, cheese paper, etc. Even then the initial outlay for equipment would be very small.

A cool room in which to manufacture cream cheese is essential. This type of cheese should be marketed or consumed immediately after manufacture, for it is doubtful whether this cheese would retain the desired flavour for more than a few days under ordinary farm conditions.

Kinds of Cream Cheese.—There are several varieties of cream cheese on the market to-day, and there appears to be no uniformity with regard to manufacture.

As the name applies, cream cheese—strictly speaking—is the product obtained by treating cream only, but the term is applied equally to cheese made from milk to which cream has been added.

Rennet Cream Cheese.—This variety of cream cheese is made from thin cream which is coagulated by the addition of rennet.

Perfectly fresh cream containing 25 per cent. to 30 per cent. butter-fat is placed in an enamel pail and regulated to a temperature of 65 to 70 degrees Fahrenheit. It should be the aim of the producer to maintain this temperature throughout the entire process.

Starter is sometimes added at the rate of one half-pint to each gallon of cream. The starter for preference should be the culture of lactic acid bacteria as used by most cheese-makers, and if regular quantities of cheese are to be made it is advisable to propagate a starter from day to day. Clean, sour milk used in amounts as outlined above will serve the purpose equally as well, especially when the cheese is intended for home use only.

As soon as the desired temperature is reached, rennet is added at the rate of six to eight drops per quart of cream. The rennet before being added is diluted with a little cold water.

The cream is then thoroughly stirred for five minutes, the basin covered with a muslin cloth and the cream left to thicken for eight to twelve hours.

When the cream has coagulated the curd is ladled on to dry linen cloths which have been spread over wooden draining racks, measuring approximately two feet square, and allowed to drain for about one hour or until whey ceases to escape. The ladling must be done with the utmost care, so that the curd is broken as little as possible.

The linen cloths should be about one yard square, and no more than one half-gallon of curd should be placed in each, or drainage will be slow and the cheese apt to become sour very quickly, especially during hot weather.

When most of the free whey has escaped from the curd on the draining rack the cloths should be tied up, bag fashion, by taking up the four corners and fastening with a piece of string and hung up to drain in a draughty place where the atmosphere is pure.

Every few hours the cloths should be opened, the cream scraped from the sides and mixed with the cream in the centre. The cloth is then retied and hung up to drain.

It is advisable to change the cream into at least one fresh cloth—indeed, the oftener the cloth is changed the quicker will be the drainage.

In cleaning these cloths they should be washed in hot water and then boiled.

Twenty-four hours at least are required for draining, but it is advisable to hasten this as much as possible, especially during the summer months. This may be done by applying a little pressure to the curd.

Place the bag of cream on the draining rack and weigh it down by placing a bucket half filled with water (about one gallon) on a board resting on the cream. Pressure should on no account be applied until the curd has been partially drained.

Drainage is complete when the cheese has a firm but pasty consistency. Salt is then added to taste; usually one teaspoonful of fine dairy salt to one half a gallon of cream will be found sufficient.

Turn the cheese out into a basin and thoroughly mix the salt with it. The addition of salt assists in bringing out the flavour.

This cheese may be moulded in various shapes. A simple form of mould is one resembling a tin lid. The mould is lined with butter muslin or grease-proof paper, into which the cheese is filled. The paper or muslin is then wrapped over the cheese and a small weight applied to give pressure for a few minutes. The cheese is then turned out of the mould. When grease-proof paper is used the cheese is usually wrapped in tinfoil or put up in cardboard boxes.

A very convenient means of marketing this cheese is in cartons or cylindrical paraffin-waxed cardboard cases obtainable in quart, pint and one half-pint sizes and fitted with a disc lid.

Yield of Cheese.—One gallon of cream with a 25 to 30 per cent. butter-fat consistency will produce about 5½ to 6 lbs. of cheese. This will serve as a rough guide when it is desired to make a particular quantity of cheese.

Gervais Cream Cheese.—This is a very popular variety of French cheese, made from a mixture of milk and cream in the proportion of two parts of milk to one part of cream.

Under local conditions, however, it is recommended that equal parts of milk and cream be used, the milk being perfectly fresh and the cream obtained from the previous skimming. The cream should contain 30 to 35 per cent. butter-fat.

The milk and cream are thoroughly mixed one half-hour before the rennet is added.

Regulate the temperature to 65 to 70 degrees Fahrenheit, and add six to eight drops of rennet (diluted with water) to each quart of the mixture of milk and cream and stir well for five minutes.

For the first three or four hours the surface of the mixture should be occasionally stirred gently to prevent the cream rising to the surface.

Ten to twelve hours will be found necessary for the curd to coagulate firm enough for ladling.

The curd is then carefully ladled out on to cloths on draining racks and allowed to drain for about one hour until most of the free whey has escaped, after which the cloths are tied up as already explained and hung up to drain.

The cloths, to assist rapid drainage, are opened frequently and the thick cream scraped from the sides and mixed with that in the centre.

When the curd is sufficiently firm, salt is added as previously described.

Moulding.—The Gervais moulds consist of six to twelve cylindrical moulds fixed to one base. The moulds are lined with blotting or similar paper and are carefully filled with the curd, pressing the curd in with a knife. The mould is then placed on a straw mat on a board and the cheese left in the moulds to drain until it is sufficiently firm. The cheese may then be removed from the moulds and stored in a cool room.

Cream cheese and Gervais cheese are best eaten when fresh.

THE EFFECT OF FEEDING SUNFLOWER SEED ON THE QUALITY OF BACON.

By C. A. Murray, B.Sc.(Agr.), M.Sc., Lecturer in Animal Husbandry, Matopo School of Agriculture and Experiment Station, Rhodes Matopo Estate, Southern Rhodesia.

One of the most common complaints of the bacon factories in Southern Rhodesia is that a very large percentage of the bacon pigs received are soft and oily and are, therefore, unsuitable for the production of good quality bacon.

Apart from the fact that unthrifty, slow maturing, unfinished pigs generally have soft fat, it has been shown overseas by Hankins and Ellis (1926-1928), and in South Africa by Romyn and others (1930), Schutte and Murray (1931) and Murray (1927-1930), that certain feeds produce a similar effect, especially those containing a high percentage of fat composed mostly of unsaturated or liquid fatty acids.

The experiment reported on in the present paper is the first of a series planned to investigate the softening or hardening properties of some feeds commonly fed to bacon pigs in Southern Rhodesia.

This experiment deals specifically with the suitability of sunflower seed as a feed for bacon pigs.

Review of Literature.—Because it has generally been considered an unprofitable grain crop in most countries (Henry and Morrison, 1923), sunflower seed has not been used extensively in overseas countries as a pig-feed, and consequently little research work has been done on its feeding qualities for pigs.

Day (1924) stated that Weaver, in a trial at the Missouri Experiment Station, found sunflower seed satisfactory when it was fed in equal proportions with maize to 100-pound pigs. Although this ration compared favourably with one of maize meal and meat meal, sunflower seed alone proved unsatisfactory.

Hankins and Ellis (1926), quoting Henriques and Hansen in Denmark, pointed out that sunflower seed produced soft pork.

In Southern Rhodesia, Timson (1928) stated: "When crushed and mixed with other feeds, it forms a valuable ingredient of the ration for cattle, sheep and pigs." Hamilton and Corry (1928) also recommended sunflower seed as a feed for bacon pigs.

PLAN OF EXPERIMENT.

The experiment was carried out at the Matopo School of Agriculture and Experiment Station during the period 3rd July, 1931, to 1st January, 1932.

Experimental Pigs.—Two similar groups of eleven pigs per group consisting of pure Large White and Large White x Large Black weaners were used. In the division of the pigs into the two experimental lots, due consideration was given to their breeding, ages, weights and condition.

Rations Fed.—The following rations were fed to the two groups of pigs:—

Group I. (Maize Group): 100 parts by weight of maize meal; 2 pounds of separated milk for every pound of concentrates fed.

Group II. (Sunflower Group): 50 parts by weight of maize meal; 50 parts by weight of sunflower seed; 1 pound of separated milk for every pound of concentrates fed.

To each of the above rations 3 per cent. by weight of minerals (consisting of equal parts of bone meal, salt and fine wood ashes) were added.

The two rations had the same nutritive ratio (1: 6.0).

The pigs were fed concentrates in the form of a thick slop, and were given as much as they would clean up in 15 to 20 minutes twice daily. Any separated milk left over after mixing with the concentrates was given at mid-day.

Both groups always had access to clean drinking water and received small amounts of green feed daily. When the latter was not available, a teaspoonful a head daily of cod liver oil was fed in the ration.

The pigs were regularly weighed at fortnightly intervals until they approached market weights. After this weekly weights were taken.

As they reached the desired finish for slaughter, they were tagged, weighed and sent by motor lorry to the abattoirs of the Rhodesian Export and Cold Storage Co., Bulawayo, a distance of 23 miles, where they were slaughtered, dressed and cured into bacon. The pigs were always sent off in the early morning (about 6 a.m.) and arrived at the factory an hour later.

After slaughtering and dressing, a number of measurements were taken, the carcasses were inspected in detail and classified into the different grades according to Duckham's (1929) standards.

1. Circumference of ham.
2. Thickness of back-fat at loin.
3. Depth of side at flank, round the outside.
4. Thickness of back-fat at back. Thinnest point.
5. Depth of side at shoulder, round the outside.
6. Thickness of back-fat at shoulder. Thickest point.
7. Thickness of back-fat at nape.
8. Length of side from the anterior end of pelvis to the anterior face of the first rib.

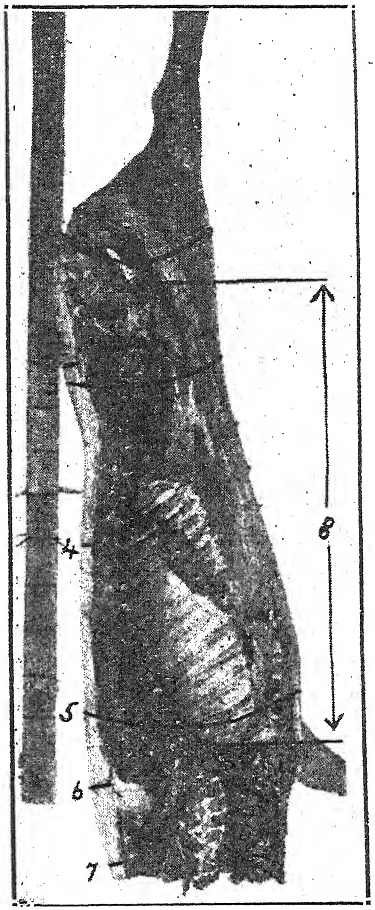


Plate 1.—Figure illustrating the positions where the carcass measurements were taken.

After chilling, the carcasses were again inspected and examined as regards the texture of the fat. Unfortunately, apparatus was not available to determine the refractive indices of the fat.

EXPERIMENTAL RESULTS.

Table I.—Comparison of average growth data for two groups of pigs fed maize and sunflower seed respectively:—

	Maize, Group I.	Maize and sunflower, Group II.	Difference and standard error of the difference between means of groups.
No. of pigs per group	10.0*	11.0	... ...
Average initial weight ... ... lbs.	58.6	60.6	1.0 ± 5.2
Average marketing weight ... ... lbs.	210.7	201.1	9.6 ± 9.7
Average initial age . . .. dys.	73.8	74.7	0.9 ± 3.5
Average marketing age ... ... dys.	200.6	209.0	8.4 ± 17.7
Average daily gain in weight ... lbs.	1.20	1.05	0.15 ± 0.06

* A few days after the commencement of the experiment one pig became sick and had to be removed from the experiment. The necessary feed adjustments were made.

Growth of Pigs.—Throughout the experiment the maize-fed pigs had a slightly more thrifty appearance than those fed sunflowers. The rate of growth for the Maize group was satisfactory (1.20 lbs. per day), but for the Sunflower group it was only fair (1.05 lbs. per day).

This difference in rate of gain in live weight, though small, is significant. The other differences are not significant. (Fisher, 1925, page 109.)

As regards uniformity in rate of daily gains, there was little difference in the co-efficients of variation (2.9 per cent.) between the two groups, the Maize group having a co-efficient of 14.1 per cent. and the Sunflower group a co-efficient of 11.0 per cent.

The marketing weight of the maize group was on the average 9.6 lbs. higher than for the Sunflower group, and this figure was reached 8.4 days sooner in the Maize group. The variation in the figures composing these averages indicates that the difference has no statistical significance.

The average marketing ages were 201 and 209 days for the Maize and Sunflower groups respectively. In practice, the former would be considered satisfactory, but the latter somewhat too high.

Table II.—Comparison of shrinkage in transit:—

		Maize, Group I.	Maize and sunflower, Group II.	Difference and standard error of the difference between means of Groups I. and II.
Average marketing weight	lbs.	210.7	201.1	9.6 $\pm$ 9.7
Average factory weight	lbs.	200.4	191.7	8.7 $\pm$ 9.7
Average shrinkage in transit ...	lbs.	10.3	9.4	... ...
Average shrinkage in transit	%	4.9	4.7	0.2 $\pm$ 0.6

Shrinkage in Transit.—In both groups the shrinkage was just under 5 per cent. Although a bit high for such a short journey, it was certainly not excessive. There was no significant difference in shrinkage between the two groups.

Table III.—Feed consumed per 100 lbs. gain in live weight, and approximate costs:—

		Maize, Group I.	Maize and sunflower, Group II.
Concentrates per 100 lbs. gain in live weight ...	lbs.	293	333
Separated milk per 100 lbs. gain in live weight ...	lbs.	587	336
Total feed per 100 lbs. gain in live weight (1) ...	lbs.	391	389
Cost per pound of gain (2)	pence	2.6	2.9

(1) Assuming 6 lbs. of separated milk equivalent to 1 lb. of concentrates.
(2) Maize meal £5, sunflower seed meal £7, bone meal £10 and salt £3 10s. per ton; separated milk 1½d. per gallon.

Feed Consumption.—It is shown in Table III. that the Maize group required 293 lbs. of concentrates and 587 lbs. of separated milk, and the Sunflower group 333 lbs. of concentrates and 336 lbs. of separated milk respectively, or reduced to a common basis of feed equivalent, 391 and 389 lbs. respectively, to produce 100 lbs. gain in live weight.

In the Maize group 25.1 gallons of separated milk saved 40 lbs. of grain, i.e., 6.3 lbs. of separated milk saved 1 lb. of grain. From the point of view of economy of growth, both rations seem to have been equally efficient.

On account of the difference in market values of the rations at the time the experiment was carried out, the cost per pound of gain in live weight was higher in the Sunflower group (2.9d.) than in the Maize group (2.6d.).

With better average daily gains than shown in Table I., and, therefore, earlier maturity, there is no reason why the cost of producing a pound of gain in live weight should not be reduced in the case of both rations.

Table IV.—Carcass measurements and grading:—

		Maize, Group I.	Maize and sunflower, Group II.	Difference and standard error of the difference between means of Groups I. and II.
Average length of side	ins.	30.8	30.7	0.1 ± 0.6
Average depth of shoulder	ins.	18.0	17.9	0.1 ± 0.4
Average depth of flank	ins.	16.7	16.6	0.1 ± 0.4
Average circumference of ham	ins.	24.3	24.2	0.1 ± 0.5
Average thickness of backfat at:—				
Nape	ins.	1.38	1.24	0.14 ± 0.08
Shoulder	ins.	2.19	1.99	0.20 ± 0.09
Back	ins.	1.19	1.05	0.14 ± 0.09
Loin	ins.	1.59	1.46	0.13 ± 0.11
Carcasses faulted on account of—				
(a) bad proportion of lean to fat ...	%	0	0	
(b) bad proportion of fat to lean ...	%	20	9	
(c) heavy shoulders	%	40	18	
(d) thin bellies	%	20	45	
Grading of carcasses (1)—				
Prime	%	50	55	
Medium	%	40	27	
Stout	%	10	9	
Inferior	%	0	9	
Carcasses with soft or oily fat (2) ...	%	0	100	

(1) In the grading of the carcasses the firmness of the fat was not taken into consideration.

(2) In the Maize and Sunflower Groups, eight and nine carcasses respectively were inspected for texture of fat. In the Maize Group all eight were firm, and in the Sunflower Group all nine were soft and oily.

Suitability of the Carcasses for Bacon Production.—From Table IV. it will be noticed that there was no difference between the two groups of pigs as regards length and depth of side and ham development.

There was a tendency throughout for the back-fat to be slightly thicker at the nape, shoulder, back and loin in the Maize group than in the Sunflower group.

Insufficient numbers were available to prove this definitely in the case of the individual fat measurements, but when the measurements for the four positions of back-fat were averaged, the tendency could be definitely proved from a statistical standpoint. (Mellor, 1902; Fisher, 1925.)

No carcasses were considered to be deficient in lean meat. In the Maize group 20 per cent. and in the Sunflower group 9 per cent. were faulted on account of excessive back-fat.

In the Maize group more carcasses were faulted on account of heavy shoulders than in the Sunflower group, and in the Sunflower group more were faulted on account of thin bellies than in the Maize group.

As regards the different grades, Duckham (1929) points out that, according to the requirements of the British market, "*prime* quality bacon is easily marketed, whereas the market for *medium* carcasses is more limited. *Inferior* and *stout* carcasses are definitely unsuitable and are not wanted."

Both groups had the same percentage of *prime* carcasses, but the Maize group had more *medium* and fewer *inferior* carcasses than the Sunflower group.

The grading does seem to indicate that the Maize-fed pigs were, on the whole, slightly fatter at marketing than the Sunflower-fed pigs. This statement is further supported by the larger percentage of carcasses faulted on account of too much back-fat and heavy shoulders in the Maize group than in the Sunflower group, and the larger percentage of thin bellies in the latter group than in the former. The slower rate of maturity and lower marketing weight of the Sunflower group probably account partly for this difference in finish.

The effect of sunflower seed on the texture of the fat was very striking. In the Sunflower group all the carcasses were absolutely soft and oily, whereas in the Maize group

all were considered firm. The carcasses from the Sunflower-fed pigs were so soft and oily that it was not possible to use them for bacon manufacture.

SUMMARY.

(1) Results are reported of an experiment conducted at the Matopo School of Agriculture and Experiment Station to ascertain the effect on the quality of bacon of feeding a ration containing 50 per cent. of sunflower seed.

(2) From a growth point of view, 50 per cent. of sunflower seed in a ration of maize meal and separated milk proved satisfactory.

(3) This ration produced very soft and oily fat without exception.

(4) There are indications from the grading and from measurements of back-fat that the pigs fed on the control ration had thicker back-fat than the pigs fed on a ration containing 50 per cent. of sunflower seed.

ACKNOWLEDGMENTS.

I am indebted to Dr. Haylett, Director of the Matopo School of Agriculture, and Dr. Romyn, Senior Animal Husbandry Officer, Department of Agriculture, for much useful assistance and criticism throughout the experiment, and with the preparation of this report.

Grateful acknowledgment is also due to the manager and staff of the Rhodesian Export and Cold Storage Co. for their co-operation and assistance and for providing the necessary slaughtering and inspection facilities.

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FERTILISER TREATMENT: ITS RELATION TO GROWTH IN TOBACCO.

By LEONARD WORTHINGTON-SMITH, Pembi Falls, Umvukwes.

Before entering into a detailed description of some experiments which I have been carrying out in an endeavour to discover the best conditions for developing the growth of the tobacco plant, I feel some explanation of the underlying principles governing the course of the tests is called for.

An immense amount of research has been carried out in America as well as in this country into every factor that can have a bearing on the problems that face the grower of tobacco, and a vast store of knowledge has been accumulated —investigations into the chemical conditions existing in the leaf during the growing period—during curing and ripening —the influences on the conditions effected by topping, suckering and so on, have been reduced to an exact science, and one can have access to tabulated results, curves and what not galore. Similarly extensive researches have been made into the varied effects of different fertilisers, taking into consideration soil conditions and so on and so on *ad infinitum*; one is deluged under a sea of facts, and I fear one emerges rather more confused than enlightened.

My own personal view has been that we should each of us try and establish a set of facts for ourselves based on the results of well thought out experiments on the soils of our own farms, for it is undoubtedly true that what may be found to be a suitable treatment to apply to the tobacco plant in one area under one set of conditions may be by no means the best on one's own area under different conditions of soil, altitude and rainfall.

The principal difficulty one is up against lies in the fact that influences of a totally different order all have a bearing on the main problem—which is to discover how to obtain

the most favourable plant growth—the original constitution of the soil—the rainfall in any particular season—and the amount and description of fertiliser applied. Before one can hope to arrive at any definite conclusion, it is essential that only one of these variable factors be investigated at one time; of the three factors mentioned above two must remain as constants and one the variable factor to be investigated. The two conditions which no one can effect, i.e., original soil constitution and rainfall I have treated as constants, and have confined myself in these experiments to fertilisers and their application.

By taking care that in all cases of comparative fertiliser experiments all the plantings to any particular tests were made on the same day from seed originally sown in the beds the same day, I have ensured that the incidence of rainfall was uniform for the whole test periods.

Similarly all separate tests have been carried on fields which showed the least soil variation—and finally all operations such as priming, topping and suckering have always been carried out simultaneously over the whole of the test plot.

This same problem of the variable factor, of course, is evident when one begins to investigate the effects of the various constituents of artificial fertilisers.

The three chemical substances with which we are concerned in the ordinary chemical fertilisers, are Nitrogen, Phosphorus and Potash, each one of which performs a definite function in development of plant growth, and though they are to a certain extent interdependent in the exercise of these functions, to attempt to test one fertiliser against another *per se* is to find oneself in a fog of uncertainty as to how far the preponderance of any one of the constituents of any one mixture over the proportion of the same constituent in another mixture may have affected the results obtained.

In my tests, which I shall presently describe, I endeavoured to concentrate my attention on the behaviour of the Nitrogen element in the various mixtures I tested—I have been under a strong impression that other things being equal the accessibility of the Nitrogen to the plant was the most important factor to be examined. In this series of experiments I determined to leave the Phosphorus and Potash

contents of the mixtures out of my calculations by keeping them as constants. The variations I introduced all concerned the form in which the Nitrogen was present, the amount applied and its general availability. Some tests carried out a few years ago concerned the effect of varying the amount of Phosphorus used, and I do not propose to go into them on this occasion.

Nitrogen is present, broadly speaking, in one of two forms in the ordinary commercial formula and sometimes in a combination of them both—in the Organic Blood Meal form or as an Inorganic Salt, such as Ammonium Sulphate, Ammonium Phosphate and Ammonium and Potassium or Sodium nitrates.

There is a difference of considerable significance between the organic and the inorganic form. The organic form of Blood Meal does not consist of nitrogen containing salts in the ordinary soluble form as in the inorganic salts abovementioned, but relies for the release of the Nitrogen contained in its constitution on complex reactions with organic and inorganic matter present in the soil and in the air—in fact, to determine the exact amount of available Nitrogen in Blood Meal is a very difficult matter. The commercial figure of availability is usually put at 12 per cent. by weight, but it is to a certain extent empirical, I believe. Furthermore, the published formulae do not state what proportion of inorganic nitrogen containing salts are blended with the Blood Meal in the mixture.

There is no doubt whatever that given ordinarily favourable conditions mixtures which rely for their Nitrogen availability partly on Blood Meal give excellent results with tobacco on most soils, and the Nitrogen is made available to the plant in a steady flow as it were through the growing period in a way which is much to be desired and these Blood Meal formulae have won their way to a popularity which has certainly been merited.

Before proceeding further it would be well to point out that the tests which I shall describe have all been carried out on a very typical sandveld soil—at an altitude of 4,700 feet, and I would hasten to add that I give such results as I have been able to obtain with the proviso that it is quite possible that they may not be found applicable to the heavier contact and diorite soils or at lower altitudes.

My first experiment was carried out to test whether Blood Meal mixtures with the same formulae but obtained from two different sources would furnish the similarity of results one would expect, and the results proved beyond question that the availability of Nitrogen to the plant varied very considerably—the growth in one instance being considerably more vigorous than the other. A plot of six acres of each formula was planted out on the 21st December, 1931, the amount of application 175 lbs. to the acre the same in each case, to see the difference in plant growth—both crops yielded well for our type of soil, taking into consideration a not too favourable incidence of rainfall, the weight per acre of the better crop was 725 lbs. per acre, and of the poorer 610. This result justified me in the opinion I have always had that the Nitrogen availability of Blood Meal was a somewhat uncertain factor—and I think it will be generally agreed that it is desirable as far as possible to eliminate all uncertain factors, if we are to get to anything like definite results and conclusions.

The next point in my investigation was to discover if possible what differences would be observed when the Blood Meal type of fertiliser was applied against the ordinary "complete" formula containing Nitrogen in the inorganic soluble form—to this end I planted a field of two plots of 5 acres each, using according to formulae exactly the same stated weights per acre of available nitrogen in each and this plot produced very interesting results. The actual application was 175 lbs. acre of Blood Meal, 150 lbs. acre double complete.

In this test it was very obvious that the "inorganic" formula suited the plant in the earlier stages better than the Blood Meal. The plants got away very much more rapidly, and, as one would expect, were of a darker colour and more robust. At the later stages of growth the Blood Meal treated plants undoubtedly showed a tendency to catch up, but this may be due to the unfavourable season—there was a distinct tendency to show more disease in the Blood Meal leaf than in the other, probably through the growth hanging fire in the earlier stages. The plants eventually reached approximately the same height, but the weight per acre was in favour of the inorganic form. Plot C Blood Meal 560 lbs. to the acre; Plot D, 620 lbs. to the acre.

I was next interested to try how the highly concentrated forms of fertiliser compared with the ordinary formulae. The advantages of the former lie, of course, in the saving of transport charges. One is faced with the fear of loss through excessive leaching and the possibility of the strong chemical mixture burning the roots and thus destroying the young plants. My tests, which were carried out on two plots of 7 acres each, showed conclusively that no disadvantages on these two counts need be feared.

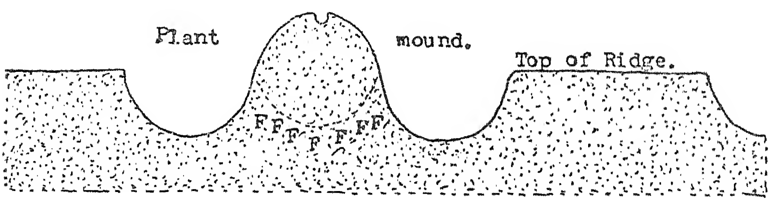
In this test a calculation was made to ensure that exactly the same amount of Nitrogen was available to the plants in both cases, the actual figures of the application being:—

(E) Highly concentrated	150
(F) Ordinary formula	215

The yield per acre of both plots was approximately the same, i.e., 630 lbs. to the acre.

It would perhaps be advantageous to describe here the method I used in the application of fertiliser to the test plots.

The land was first ridged in the ordinary way and then check rowed across the ridges, holes being made with the hoe about 8 inches deep. The fertiliser was then sprinkled round the base of these holes in a circle roughly a foot in diameter, and then thoroughly incorporated into the soil with a hoe (F). Finally a heap from 10 inches to 12 inches high



was drawn over the hole from the surrounding land and marked with a knob at the end of the hoe to indicate where the plant should be inserted—the ridge is drawn up just around the plant, but sufficient of the ridge remains between the plants to ensure good drainage in heavy rain. The fertiliser being well distributed there is little risk of burning of the roots nor is there any fear of leaching.

My final test, and perhaps the most interesting, consisted of 4 plots each 3 acres in extent, in which I compared Blood Meal, highly concentrated, double complete and Blood Meal with extra Superphosphates in the proportion of 2 Blood Meal, 1 Phosphate, using the same amount of Nitrogen in each case. Here, again, the results obtained agreed with those of the second test, inasmuch as the Blood Meal plants lagged behind until the very last and were not so vigorous in growth. The effect of the extra Phosphorus in the last test was a distinctly yellower appearance in the leaf and lightness in body.

As a result of the series of tests, I have established in my mind the fact that the readiness in the availability of the Nitrogen in the plant is the all important factor, and I feel that provided the ill effects of leaching are guarded against there is a distinct advantage to be obtained from the use of salts in which the Nitrogen is present in highly soluble form. I have an impression that there is no difference in the tendency of the plants to develop spot, though I am aware that there is a theory current in the minds of many that the so-called "complete" fertilisers have this defect.

There is no doubt that the prevalence of disease in the form of the different types of spot and white mould is the most serious menace we have to fight, and the whole matter is closely bound up with the conditions of plant growth. Everyone is aware that the liability of the plant to disease is affected by the way it is handled during the period of growth, the most critical stage being reached when the time for "topping" arrives. It has been my experience for a number of years that this process is carried out usually too soon. I have definitely proved to my own satisfaction, and I give it here for what it is worth, that the best time to top in an ordinary season is when practically the whole field has been in full bloom for at least a week, taking the flower head off only and leaving the small top leaves on the plant, and then, if the weather conditions promise a dry spell, subsequently to take off one or two of these top leaves a fortnight or so later, in fact, I invariably carry out the process of topping in two operations. Bearing in mind that the action of topping causes the uprush of "sap" which would otherwise be utilised in the formation and development of the seed to be absorbed by the leaf it is easy to understand that

the pressure of this stream so exerted causes the leaf to increase in body abnormally quickly, and suckers to emerge as an outlet for this pent up energy. The "skin" of the leaf, if so I may describe it, becomes subject to excessive tension, and just as a person who persistently over-eats himself will be likely to grow fat and to develop an unhealthy skin, so the leaf is distended and the skin is rendered extremely thin and liable to damage. A heavy rain will cause actual fracture, which may easily be seen under the microscope, and then when this is followed by hot sun and wind the fracture parts can be seen to have developed into "sores" as it were, and spot is likely to develop at once; for this reason I believe it is advisable to go very steadily, and by topping not too drastically, to ensure that this exertion of extra pressure in the leaf is made as gradual as possible—there is, however, one danger to guard against, and that is the development of mould or white rust. A plant if left untopped too long is very liable to this disease, and what we have to try and do is to "top" at such a period that reaping will be well on the way before mould has begun to develop; high priming is undoubtedly a preventive factor, as mould seems to develop always upwards from the bottom of the plants.

It may be said that considerable weight will be lost through late topping—the leaf not developing fully—but I incline to the view that this is a mistaken notion. It has been my experience that the leaf is of better texture, is not so coarse and certainly cures better if the plant is topped in the way I have indicated.

My reason for putting forward these suggestions on the process of topping is that the subject of plant growth has to be treated as a whole—and I incline to the view that though we may find the perfect fertiliser to produce the ideal development of the tobacco plant, unless the handling of the plant during the growing period is treated with judgment, our efforts are largely negatived—*the danger to be avoided is "topping" too soon;* in every case under my notice when this has been done the damage done by the inroads of spot has rendered the leaf nearly valueless, and I would say with some certainty it is better far to top too late and even too high than too early and too low.

If care be exercised to watch the growth of the plant, and especially the vigour of the growth, it is not a difficult matter so to govern the processes of topping and the removal of suckers in such a manner that the leaf never becomes over-heavy and coarse for its type, and I think generally it will be found that the likelihood of the incidence of disease is very distinctly minimised.

In conclusion, I would like to say that the tests and experiments I have been describing have all been carried out with White Stem Orinoco, and that this type of tobacco seems to develop very good body under the conditions of topping and suckering I have described.

SOUTHERN RHODESIA WEATHER BUREAU.

JULY, 1932.

Barometric Pressure.—Pressure was normal for the month.

Temperature.—The maximum and minimum temperatures recorded during July were below normal, especially the minimum temperatures. Frosts were very prevalent during the month.

Rain.—Light showers fell in Lomagundi on the 5th and 6th, and a little drizzle was experienced in the south-eastern part of the country. Apart from this there was no rain.

JULY, 1932.

Station.	Pressure Millibars, 8.30 a.m. Mean.	Pressure Normal.	Temperature in Stevenson Screen °F. Absolute. Max.	Absolute. Min.	Mean. Max.	Mean. Min.	Mean. ½ Max. Min.	Mean. Normal.	Mean. Dry Bulb.	Mean. Wet Bulb.	Rel. Hum. %	Dew Point F.	Cloud Amt. 0-10	Precipitation. Ins.	Precipitation. Normal.	Precipitation. No. of Days.	Altitude (Feet).
Bulawayo ...	873.7	873.6	74	32	68.1	40.7	54.4	56.9	54.1	44.7	45	34	1.3	...	0.1	...	4,436
Gwelo	867.1	...	73	29	67.6	39.4	53.5	55.6	52.8	45.3	55	37	1.7	...	...	...	4,632
Riverbank ...	...	...	81	29	73.9	40.5	57.2	58.7	50.7	43.7	56	36	...	...	...	...	4,100
Essexvale ...	...	...	86	27	77.0	35.2	56.1	57.1	43.8	39.6	68	34	..	...	0.1	...	3,828
Gwanda ...	912.2	...	79	29	71.3	38.4	54.9	...	54.3	45.8	50	37	1.5	...	0.1	...	3,235
Mazunga ...	...	...	86	31	76.0	40.0	58.0	61.2	56.6	49.2	59	43	1.3	...	0.1	...	1,970
Nuanetsi ...	...	...	85	31	76.7	39.2	58.0	..	55.4	48.2	59	42	2.4	...	0.3	...	1,630
Between Rivers	...	...	80	27	71.3	36.4	53.9	...	48.4	44.7	75	41	1.3	0.07	0.2	1	3,970
Enkeldoorn ...	...	...	74	32	67.9	41.1	54.5	56.1	54.7	47.1	55	39	2.5	...	0.1	...	4,720
Gatooma ...	...	...	78	32	72.7	39.2	56.0	59.1	55.6	48.8	61	43	1.9	...	...	...	3,850
Miami	854.5	...	76	37	70.2	43.4	56.8	...	56.1	49.5	62	43	0.9	0.08	...	1	4,090
Salisbury ...	859.3	859.8	75	32	69.3	40.8	55 1	56.3	55.5	47.9	57	41	2.2	...	...	...	4,890
Sinoia, Citrus ...	...	...	76	32	72.2	38.8	55.5	...	52.3	46.6	64	41	...	...	0.1	...	3,83C
Sipolilo... ...	...	...	74	36	69.7	44.4	57.1	...	58.0	50.2	57	43	1.6	0.01	...	1	3,900
Mtoko	...	...	72	41	68.0	45.8	56.9	...	56.4	50.7	67	46	2.6	...	...	...	4,210
Shamva ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3,170
Angus Ranch ...	...	...	82	41	74.1	47.1	60.6	60.4	56.2	50.3	66	45	...	...	0.2	...	2,300
Craigendoran ...	...	...	80	31	73.9	42.0	58.0	...	61.4	53.7	60	48	...	...	0 2	..	3,430
New Year's Gift	...	...	80	42	72.9	47.3	60.1	...	55.5	49.4	65	44	...	0.01	0.2	1	2,700
Nyamasanga ...	...	...	72	33	67.3	41.3	54.3	...	57.5	46.8	52	40	...	...	...	...	5,680
Riverdene North	...	...	80	24	72.0	33.3	52.7	...	42.3	39 1	75	35	...	...	0.2	...	3,700
Stapleford ...	...	...	67	28	59.8	34.8	47.3	...	51.2	46.3	69	42	2.2	...	0.1	...	5,450
Umtali	898.4	898.4	78	38	69.0	44.7	56.9	58 4	57.4	50.8	62	44	1.8	...	0.3	...	3,677
Victoria ...	...	...	78	29	69.7	37.4	53.6	55.0	50.8	43.8	56	36	2.3	...	0.1	...	3,570
Melsetter ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.8	...	5,060
Mount Selinda	...	...	76	38	67.3	44.7	56.0	...	58.5	51.3	61	45	0.8	0.07	1 0	2	3,520
Manchester ...	...	...	67	34	61.7	41.0	51.4	...	45.8	42.9	79	39	...	0.02	...	1	...

STUDIES ON THE IMPROVEMENT OF NATURAL VELD PASTURES.

No. 2

By A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.

Note.—The following article was first printed in this Journal in February, 1931. *Owing to the constant demand it has been out of print for some time, and it is now reprinted by special request.—Editor.*

"Grass bears no blazonry of bloom to charm the senses with fragrance or splendour, but its homely hue is more enchanting than the lily or the rose. It yields no fruit in earth or air, yet should its harvest fail for a single year famine would depopulate the world."—*Farm Notes,* October, 1930.

The question of the conservation, management and possible improvement of natural pastures is of great importance to every agriculturist and stock breeder in Southern Rhodesia. In spite of the fact that in many areas of the country the quantity factor of the grazing appears ample, experience has taught stock breeders that high grade or pedigree cattle rapidly lose their productive capacity if left to graze on the veld without supplementary feeding. It is also recognised that even scrub stock in many parts of the country require supplementary mineral feeding in order to keep them in good health, and it is fully realised by the majority of farmers that there is apparently some deficiency in the natural grazing.

Chemical analysis of the veld herbage shows that the protein and mineral contents of the ordinary veld grasses are considerably lower than those of improved pastures in Europe, which is the type of grazing to which the imported

stock have been accustomed and which they require if they are to maintain their productivity.

It is a known fact that unless pastures in Europe receive proper management and manurial treatment they rapidly deteriorate, and it is also known that in certain cases sheep grazing on unmanured hill pastures are prone to suffer from certain diseases associated with dietetic deficiencies unless periodically driven down and allowed to graze on richer low-land pastures. These facts clearly demonstrate that only by careful methods of pasture management and attention to manurial treatment is it possible, even in Europe, to maintain the productivity of high-producing animals and to make stock-raising an economic proposition. It is very little wonder, therefore, in Africa, where practically no attention or consideration is given to the natural pastures, that these animals when placed upon the veld are found to lose their productive capacity. The probability that many of the difficulties connected with stock-raising experienced in this country may be due indirectly to faulty nutrition is evidenced by the great improvement in health resulting from the feeding of protein and mineral supplements to grazing animals in many parts of South Africa. The question as to whether it is more economic to feed the eminerals to the animals direct or to endeavour to influence the protein and mineral content of the grasses by application of mineral fertilisers to the soil has, however, received very little attention.

It is generally considered that fertilisation of natural veld pastures cannot be economic, although no experimental work to determine this has ever been carried out. It has been established quite definitely that fertilisation of arable land is economic, and it is difficult to understand, therefore, why fertilisation of grassland, at least in certain circumstances, should not also prove so. The fact that investigational work has already shown us that fertilisation of grassland not only increases the quantity, but also improves the quality, and hence is bound to reflect itself on the health and productive capacity of the animal, must be taken into consideration in studying the economics of the problem. In many cases the value of the cattle lost through so-called "poverty" would, had it been possible to keep them alive, have paid the cost of fertilisation of many acres of

grassland. The degree to which animals suffer from malnutrition on poor or deficient pastures is dependent mainly upon their rate of growth and productivity. Pastures suitable for small and slow-growing native stock may be entirely unsuitable for rapid-growing and high-producing grade or pedigree stock. Although it may not be economic to fertilise pastures for scrub cattle costing about £3 to £5 per head, it may be economic to fertilise for grade or pedigree beasts costing anything from £10 per head upwards.

The efforts of present-day stock breeders in Africa to evolve higher producing animals than the native stock make the problem of the improvement of the natural veld grasses one of extreme importance. Although in some cases it may be necessary and more practicable to feed minerals in the form of licks to the animals, it must not be forgotten that such methods exercise but little influence on the carrying capacity of the land and cannot be expected to correct or improve the palatability, digestibility or nutritive value of the grazing. All of these factors are influenced by treatment of the soil, and there is no question but that the best method of increasing the mineral intake of animals grazing on mineral-deficient pastures is to increase the mineral content of the grasses by enriching the soil. By this method the quantity factor is increased, the minerals are given in the form that will ensure the maximum assimilation by the animal, and at the same time the feeding value of the grass is increased in other ways.

In addition to the question of fertilisation, there is the all-important problem of methods of veld management. The practice of ranging cattle the whole year round may be suitable for native and scrub stock, but certainly is not suitable in most parts of the country for high grade stock. Recent research on pastures in Great Britain has demonstrated that the period of the maximum feeding value of a pasture can be controlled partially at least by methods of pasture management, and that this value varies according to the stage of maturity of the plant and the incidence of the rainfall. The results of a recent experiment carried out at the Salisbury Experiment Station show that the feeding value of the veld grass, as judged by chemical analysis, rapidly falls after the rains have ceased, and that one ton

of hay cut at the beginning of April is equal in food constituents to two tons cut in May.

This finding alone means that even on very poor pasture the cutting of the grass for hay at the correct time of the year results in a product having twice the protein content of the grass left standing on the veld. Were farmers to adopt this practice it would probably mean that their losses of stock from "poverty" would be reduced considerably and that in many cases grass having a minus feeding value would be converted into hay with one at least sufficient to supply maintenance.

Investigatory work into problems of veld management in Africa should produce results of great economic importance and should enable us to utilise to a far greater extent the potential food material contained in the vast areas of grazing land throughout the country.

In a previous paper published in the *Rhodesia Agricultural Journal* in September, 1928, reference was made to the fact that numerous experiments in other countries had shown that the feeding value of grass may vary considerably, according to its stage of maturity. It is a fact well recognised by farmers in Southern Rhodesia that at the beginning of the rainy season cattle grazing on the veld rapidly improve in condition, although the amount of young grass is limited, whereas at the end of the rains, although the quantity factor of the grazing is ample, cattle rapidly fall off in condition.

The system of pasture management known as "close-grazing," which has received so much attention from agricultural research workers in Europe, has demonstrated the high nutritive value of young grass as compared with mature grass and has shown that by a suitable system of rotational grazing the carrying capacity of pasture land may be considerably increased. In order to ascertain the difference in the feeding value of veld grass during each month of the year a series of analyses of the veld herbage has been carried out in the chemical laboratories on the same plots used for the experiment detailed in the report previously mentioned. In addition to these analyses it was decided to mark off several small areas on the plots which were to be cut regularly each month, with the object of simulating rotational

grazing, in order to demonstrate the difference between the nutritive value of the short young grass and the ungrazed and more mature grass.

It will be seen from the results detailed below that the probability suggested in the previous article—that the feeding value of our grasses is much lower during the latter part of the rainy season than during the early part—is borne out by the analysis of the grasses cut later on in the season.

The plots received no further manurial treatment after the season 1928-29 than that detailed in the article mentioned ("The Importance of Research on Pasture Improvement in Southern Rhodesia," *Rhodesia Agricultural Journal*, September, 1928). The last application of fertiliser was therefore given in November, 1928, and although it is not intended to stress the point in this further article, the residual effects are still noticeable, both in the quantity and the quality factors. Let it suffice to call particular attention to the former, with the undernoted figures.

TABLE I.

	1929 yield of hay per acre. Lbs.	1930 yield of hay per acre. Lbs.	Total yield per acre for 1929 and 1930. Lbs.	Increase over control for 1929. Lbs.	Increase over control for 1930. Lbs.	Increase over control for 1929 and 1930. Lbs.
Nitrate of soda + potash + super	3,492	2,600	6,092	2,084	1,386	3,470
Sulphate of ammonia + potash + super	2,900	2,166	5,066	1,492	952	2,444
Control (no fertiliser)	1,408	1,214	2,622	...	...	...

The figures showing the marked increase in bulk of hay as the result of one average application of fertiliser in two years require no comment, speaking as they do for themselves. It was originally intended to repeat cutting and weighing for at least one more year, but owing to

building requirements the ground is unfortunately no longer available.

Experimental Procedure.—The chemical analyses were again made on all three plots, but as our intention here is to demonstrate the value of close-grazing as compared with the usual method adopted of allowing the pasturage to mature, the tables below show only the results from the best of the three plots, that which received nitrate of soda. Equally as convincing and very similar contrasts were, however, obtained from the remaining two plots, but to avoid any possible confusion of the issue these are not reproduced.

Six yard-square quadrats were staked out, two on each area, and from these were obtained the samples of monthly cuttings for analysis. The cuttings were made by hand by means of a pair of shears on the 7th of each month, from 7th December, 1929, onwards. Previous to cutting, all weeds were removed, as observations have shown that stock graze these only slightly, and the grass was clipped as low as could conveniently be managed in order to simulate very close paddock grazing. It was well-nigh impossible to avoid including particles of grit and sand with the samples, so after air drying for several days the material was well shaken over a 3 mm. sieve and, all particles of extraneous matter having been removed, was ground to a powder in an electric grinder, bottled and analysed.

Simultaneously with these cuttings, corresponding ones were made alongside on the veld grass allowed to grow naturally, care being taken throughout that no two samples were ever obtained from the same spot. These samples were treated in every way similarly to the above, and represent ordinary ungrazed veld herbage. This part of the experiment was carried out throughout the complete period of twelve months, the last cutting taking place on 7th November, 1930. The close-grazing cuts had to be discontinued after that on 7th April, 1930, when, owing to the cessation of the rains and the consequent end of the growing season, there was insufficient material remaining for the purpose of analysis.

In the tables below all results are calculated as percentages on 100 per cent. dry matter.

TABLE II.

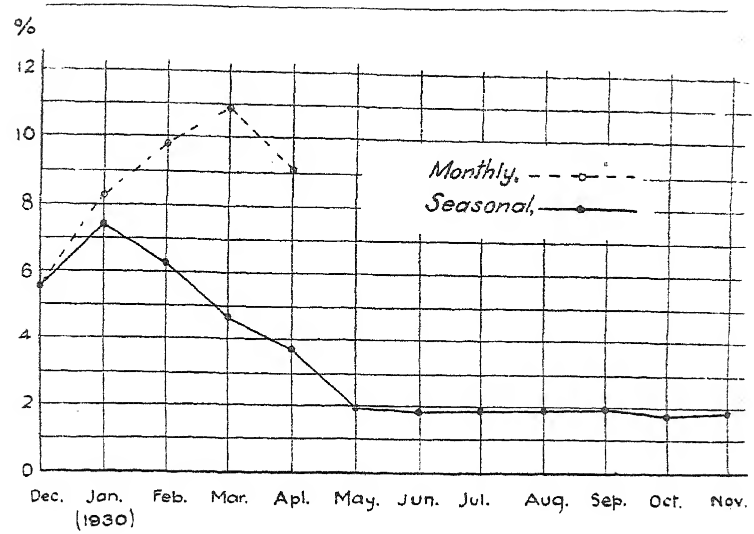
Composition of Grass of one month's growth only—corresponding to close-grazed veld.

Rainfall for preceding month.	Date of cutting.	Ash.	Acid-soluble ash.	Ether extract.	Fibre.	Nitrogen.	Crude protein.	True Protein.	Lime (CaO).	Phosphorus. (P_2O_5)	Chlorine (Cl).	Potash (K_2O)	Nutritive ratio.
Inches.		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
8.00	7.12 29	12.21	3.39	2.14	37.03	0.87	5.44	5.16	0.624	0.388	0.223	0.86	15.7
3.52	7.1.30	9.70	4.48	2.33	30 07	1.32	8.25	7.50	0.598	0.659	0.246	2.04	10.3
5.10	7 2.30	12.61	4.58	1.71	34.61	1.57	9 82	7.95	0.531	0.740	0.486	1.71	8.1
4.82	7.3.30	12.58	5.40	1.93	32.44	1.73	10.79	9.68	0.585	0.841	0.395	2.08	7.3
0.85	7.4.30	13.35	5.52	2.16	29.76	1.46	9.09	7.18	0.765	0.707	0.421	2.93	8.8

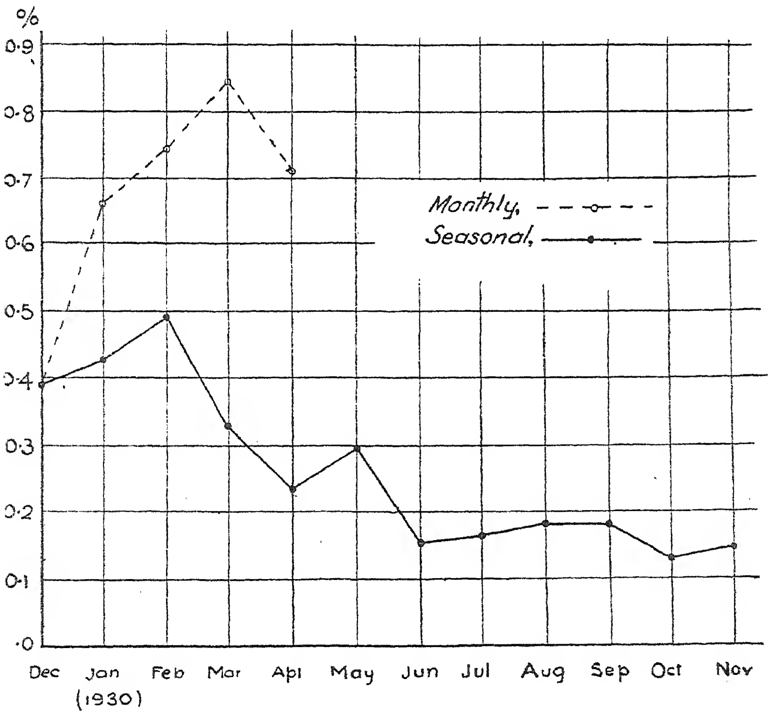
TABLE III.

Composition of Ungrazed Grass from month to month.

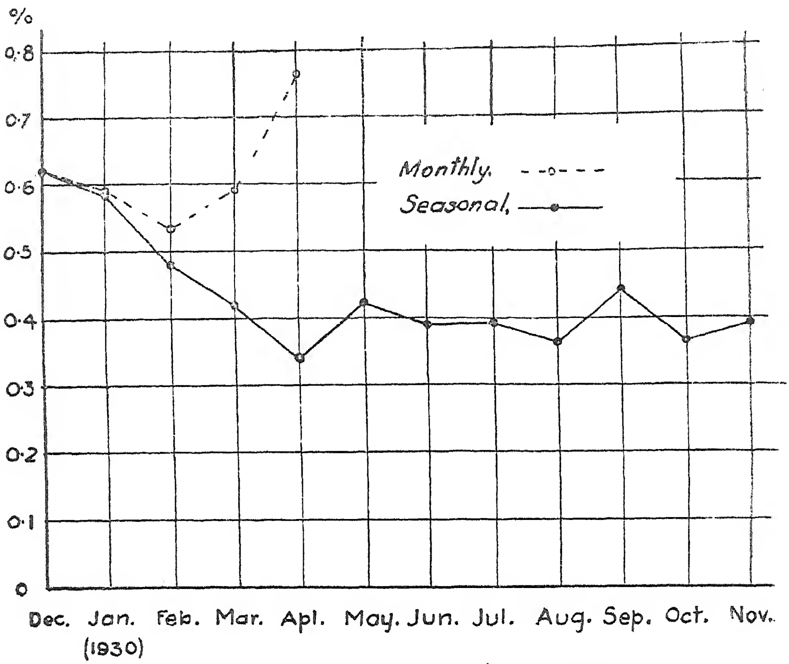
Rainfall for preceding month.	Date of cutting.	Ash.	Acid-soluble ash.	Ether extract.	Fibre.	Nitrogen.	Crude protein.	True protein.	Lime (CaO).	Phosphorus (P_2O_5)	Chlorine (Cl)	Potash (K_2O)	Nutritive ratio
Inches.		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent	Per cent.	Per cent.	Per cent.	
8.000	7.12 29	12.21	3.39	2.14	37.03	0.87	5.44	5.16	0.624	0.388	0.223	0.86	15.7
3.520	7. 1.30	10.93	4.61	2.17	32.23	1.18	7.40	6 07	0.591	0.425	0.375	1.92	11.4
5.100	7. 2.30	10.68	4.94	1.35	38.00	1.01	6.33	4.90	0.477	0.494	0.425	1.81	13 4
4 820	7. 3.30	8.13	3.80	1.34	43 61	0.76	4 73	3.44	0.421	0.328	0.248	1.53	18.8
0.850	7. 4 30	7.18	3.06	1.24	43.67	0.60	3.72	2.85	0.336	0.235	0.176	1.34	24.4
0.330	7. 5 30	6.57	2.35	1.86	42.71	0.31	1.95	1.82	0.422	0,297	0.154	0.88	48.2
...	7. 6.30	7.88	2 04	0.95	44.67	0.30	1.89	1.45	0.386	0.151	0.138	0.76	48.4
0.060	7. 7.30	7.29	2.04	1.13	44.31	0.31	1.92	1.47	0.392	0.162	0.110	0.77	48.0
...	7. 8.30	7.57	2.69	1.34	40.60	0 31	1.93	1.86	0.358	0.181	0.278	0.58	47.9
...	7. 9.30	8.50	3.11	1.07	42.49	0.32	1.99	1.89	0.435	0.181	0.170	0.79	45.4
0.125	7.10.30	7 25	2.09	0.98	43.70	0.28	1.73	0.93	0.365	0.126	0 119	0 41	53.4
...	7.11.30	7 34	2 07	0.68	42 21	0.29	1.84	1.06	0.392	0.147	0.093	0.46	50.0



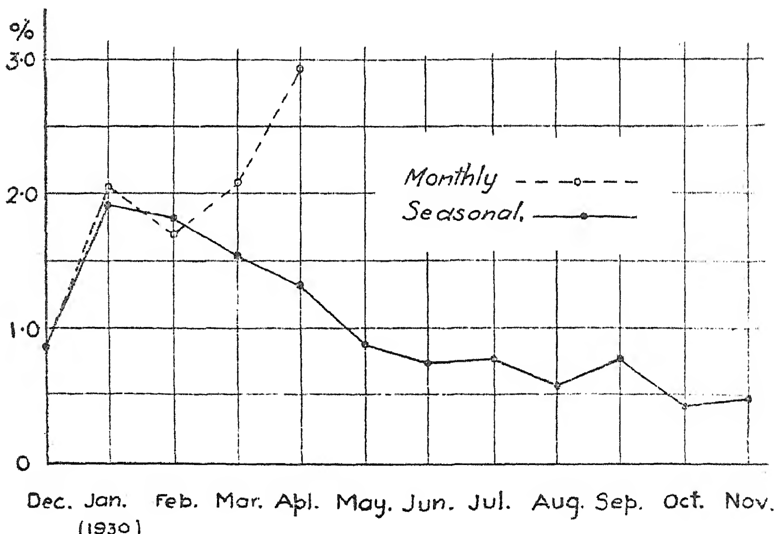
Graph I, Crude Protein



Graph II, Phosphoric Oxide (P_2O_5)



Graph III, Lime (CaO)



Graph IV, Potash (K_2O)

Analysis and Discussion of Data.—*Crude Protein.*—There are two striking points of interest with regard to this. The first is the lamentable one that in neither of the two series does the protein content at any time approach that of an average European grass. Cruickshank, in her studies into the seasonal variations of pastures, gives the figure of 20.8 per cent. for her "Good Pasture" and 10.9 per cent. for the "Poor Pasture." The highest result obtained by us, namely that for the monthly cut in February, 1930, was 10.79 per cent., a figure only exceeded in poverty by that of 8.37 per cent., which is the percentage content given in the records of the Rowett Institute for a sample taken from the Island of Lewis. Low though 10.79 per cent. is, however, compared with average European figures, it is almost 130 per cent. higher than the result obtained for the seasonal cut of the same date from the same plot, and 46 per cent. higher than the maximum for the year of the latter series, obtained from the January cutting, and this brings us to the second important point of interest.

Graph I. shows clearly the percentage of crude protein of the monthly cut herbage to be very markedly higher throughout than that of the grass allowed to mature naturally. Striking though the graph is, the figures are even more so, for the maturing grass shows an average of 5.52 per cent. for the months December to April, whereas the grazed grass gives 8.68 per cent., an increase of 57 per cent. It may at this point be observed that the average crude protein content for the whole twelve months of the grass allowed to mature amounted to only 3.4 per cent., but the nature of the experiment did not permit of a direct comparison being made in this respect with the other series, except that, were our five months grazed samples distributed over the whole year, the average would be 3.6 per cent.

Phosphoric Oxide.—Whether there is any direct relationship between the seasonal variations of the contents of phosphoric oxide and of crude protein is a matter which will require, and which must receive, further investigation, but when Graph I. (crude protein) and Graph II. (phosphoric oxide) are compared, the similarity of the curves, as far as they go, is at once apparent. In the monthly cuttings in

each case a decided upward gradient occurs for three months, after which there is as distinctly a downward movement. In the seasonal samples, the same rise and fall is also evident in both, but here the crude protein reaches its apex after one month, whereas the culminating point for the phosphoric oxide is attained only after the second month has finished.

The results obtained for the phosphoric oxide content of the monthly samples are startling. The maximum is .841 per cent., obtained from the March sample, and this figure, apart from being the highest yet obtained from these plots, even when directly under the influence of fertilisation, is markedly higher than any one of those given in the Rowett Institute list already referred to, where the top figure is .74 per cent. from "cultivated pasture." It is 156 per cent. higher than the seasonal content of .328 per cent. for the same month, and 70 per cent. higher than the maximum seasonal content of .494 per cent. for the month of February. The average monthly content for the five months under review is .667 per cent., that of the seasonal cuts for the same period .374 per cent., a lead for the former of 79 per cent. The average for the year of the seasonal cuttings amounts to merely .259 per cent.

The exceedingly rapid drop from .297 per cent. in May to .151 per cent. in June, after which there is little variation, is due undoubtedly to the fact that most seeds containing a high percentage of phosphoric oxide have fallen to the ground in the intervening month, and so would not be contained, as previously, in the sample.

It is interesting to note that the young short grass shows no phosphorus deficiency, despite the relative phosphorus deficiency of the soil. In the more mature grass the phosphate content is certainly below that of pastures in Great Britain, but on the whole it cannot be stated that this pasture shows any marked deficiency of phosphorus until towards the end of the rainy season. One cannot, of course, state that on all pastures throughout the country the same relatively high phosphate content will exist, but taking European cultivated pastures as a standard, the pasture studied in this experiment shows a more marked relative deficiency of protein, potash and chlorine than of phosphorus.

Lime.—Graph III. shows the variations in the lime content. The monthly cuttings show a fairly rapid ascent in the contents of this constituent, commencing with the cutting on 7th February, after which date the rainfall began to decrease, and continuing to the comparatively high figure of .705 per cent. in April, when these observations ceased. Czapek (1920), quoted by Henrici, in a resumé of the literature on the subject, states that a continuous increase of the calcium takes place with the advancing season. Henrici, for veld grasses of the Eastern Transvaal high veld, found the accumulation of calcium in autumn and winter distinct in nearly all her grasses, but that the increase was nowhere as much as in Europe. Our plots showed no such increase; there was a steady fall of calcium in our seasonal cuts from December (.624 per cent.) until April (.336 per cent.), after which, with slight rises and falls, the figure remained on an average of .39 per cent. This, however, is quite comparable with Henrici's results for her Eastern Transvaal grasses, but considerably lower than what is normally obtained from good British pastures. The average for our five monthly cuts was .62 per cent.

Potash.—A reference to Graph IV. and the potash figure in Table III. shows that there is a marked deficiency in this constituent of our grasses as compared with cultivated pastures in Great Britain, which average 3.18 per cent. The average for the growing period of five months in ours is 1.92 per cent. for the monthly cuttings, and 1.49 per cent. for the seasonal cuts, the former rising to the excellent peak of almost 3 per cent. in April, when the rains have well-nigh ceased for the season, as against 1.34 per cent. for the latter. The average for the rest of the year in the mature grass stands, however, at the low figure of .66 per cent. Except for a small inexplicable rise in September, there is a steady decline in the seasonal samples from the maximum of 1.92 per cent., which was attained in the January cut, to the very low figure of .41 per cent. recorded in October.

Chlorine.—The chlorine figures vary throughout the year, the only points of interest being that each series of cuts shows its maximum in the February sample, after which there is a variable but steady decline throughout the

remainder of the year in the seasonal cuttings, whereas the monthly samples fell considerably in March, but rose slightly again in April. The content throughout is exceedingly low, compared with European natural pastures.

While the chlorine requirement of cattle is not at present known, it is probable that it is fairly high, owing to the fact that the chlorine is required by the animal in fairly large quantities for the production of hydrochloric acid in the stomach for digestive purposes. Even in Great Britain it is common practice to supply ordinary salt or rock salt to farm animals to satisfy a salt craving, and it is quite possible that the great craving of animals in this country for salty substances may be due to this deficiency of chlorine in our natural pastures.

Figures for sodium and magnesia are not given; the sodium content over all was found to be negligible, and the magnesia remained almost constant between .25 and .30 per cent.

Acid Soluble Ash.—This important estimation demonstrates probably more conclusively than any one of the others taken individually how the total soluble mineral content of the grass is improved by frequent grazing. Whereas there is a consistently steady increase from the first cutting until the end of the experiment in the monthly cuttings, there is as steady a decline in the other set, the result at the end of the year giving the remarkably low figure of 2.07 per cent. For June and July the total reached was only 2.04 per cent., comparing most unfavourably with 5.52 per cent. reached in the monthly cuts in April.

Ether Extract and Crude Fibre.—Little interest attaches to these. For the monthly cuts the ether extract remains constantly on the borders of 2 per cent., while in the other it descends almost uniformly from 2 per cent. to just below 1 per cent., finishing up in November with the low content of .68 per cent.

The crude fibre figures are on the whole higher than those obtained from the same plots for the two preceding years. This is evident in both sets of cuttings, but the monthly set at the end of its sampling had reduced its content to 29.8 per cent., whereas the seasonal had increased to 43.7 per cent.

This was, however, only what was to be expected, but it is a point of interest that right throughout both sets of cuttings, with the one exception of the last seasonal cut, the fibre has uniformly increased as the ether extract has decreased.

Nutritive Ratio.—The nutritive ratios are, of course, calculated on crude nutrients only. The results are self-proclaiming. Hay cut in February has a ratio of 1: 13.4, its aftermath one of 1: 7.3. Hay cut in April has one of 1: 24.4, while a month later in May it has widened to 1: 48.2.

The average ratio for the five monthly cuts is 1: 10, for the corresponding five seasonal cuts 1: 16.7, and for the whole year of the latter 1: 35.4.

From the above results, one is fairly justified in concluding that by a suitable system of veld management, including rotational grazing, the nutritive value and the carrying capacity of natural veld can be greatly enhanced. As one would naturally expect from research that has been carried out in other countries, it has been found that the feeding value of young grass in this country is very much higher than that of grass which is allowed to mature. Evidence is produced to show that the feeding value of our grasses is largely dependent on the stage of maturity, and not solely, as is generally supposed, upon the season of the year and the incidence of the rainfall. This indicates one or two direct lines upon which it may be possible, without the expenditure of a penny in fertiliser treatment, better to utilise the natural grazing of the veld.

The first line of attack would appear to be the controlling of the grazing lands by a system of paddocking and rotational grazing. It is true that this means additional expense in the matter of fencing, but such expense is unavoidable and would undoubtedly prove to be justified when distributed over a number of years. The size of the paddocks would naturally depend upon the number of cattle carried, and no definite standard can be laid down with regard to this.

The second important point brought out in the above experimental work is the necessity of cutting the hay at the correct stage of maturity in order to make the best use of it. It is quite clearly shown that there is a considerable difference in the feeding value of grass from month to month

during the growing season, and that the more the season advances the more rapidly the feeding value of the grass decreases.

From analytical data, it appears that the grass has its maximum feeding value during the month of January. The volume of grass during this month of the year would, however, hardly pay for its cutting. Although there is a fall in the protein content of the grass between January and February, yet during the month of February it has a very much higher feeding value than during the month of March. As its volume is quite good in February, it would appear that when the season permits, this would be the most profitable time in the Salisbury district to cut hay. Where it is possible to cut in this month, one could expect quite a reasonable aftermath, which would be very valuable for grazing purposes. This finding must not be taken as the best time for the whole of the country, it having been noted from the pasture research going on in Matabeleland that the most profitable time in that area is about one month earlier.

Although one realises how difficult it is for the average farmer to find the time and labour in the middle of the rainy season for the cutting of hay, the fact still remains that the extra effort in doing so during this month would be amply repaid by the value of the hay obtained as compared with hay cut later in the season.

The finding that the feeding value of our grass is largely dependent on its stage of maturity indicates that on farms where it is impracticable to cut grass for hay during the month of February, attempts should be made to check the growth of the grass by grazing during the early part of the growing season, say until some time in January, and then allowing the grass to go to hay after this date. It could then be cut later on during the season, probably in the month of April, and still have a high feeding value. It is true, of course, that by this latter method the yield of hay would be considerably reduced, but there is no doubt that this would be offset by its increased value.

The analysis of the mineral content of the grass under the two systems shows quite clearly that the percentage of

all the minerals is considerably higher in the grazed than in the ungrazed grass. The figures rather indicate that where such a system is practised there would be very little necessity to feed any minerals in the form of licks during the growing season. The high phosphate content of the short grass is a rather remarkable finding in view of the phosphate deficiency of our soils and the general belief of all stock breeders that it is necessary to feed to all animals right through the year some form of phosphatic mineral lick.

The question of the value of mineral fertilisation of the veld is being further studied at the pasture research stations both in Matabeleland and Mashonaland, and it is hoped that at a future date it will be possible to make some definite statement and recommendations regarding this aspect of veld improvement

SUMMARY.

From the results quoted and the analyses of these which have been made, the following points emerge:—

1. The bulk of hay obtained over a period of two years from a plot which received one normal dressing of complete fertiliser was 132 per cent. higher per acre than from a corresponding adjoining plot which received no fertiliser. In the latter plot the yield was just over $1\frac{1}{4}$ tons per acre; in the former it was just over 3 tons.

2. The crude protein content of the normal veld grass was found to be much below the standard of a natural average European grass. It was highest in January, with a total of 7.40 per cent., after which it rapidly declined to the miserable figure of 1.73 per cent.

3. Monthly clipped grass, intended to simulate close-grazing, gave much higher figures, rising to 10.79 per cent. crude protein at the beginning of March, and only falling to 9.09 per cent. in April, when the rains had virtually ceased.

4. The phosphatic content of the young grass, grazed monthly, was strikingly higher than that of the mature herbage. The former reached its summit in March with .841 per cent. phosphoric oxide, which is more than $2\frac{1}{2}$ times the amount contained in the mature grass on the same date.

The phosphoric oxide in the mature grass was low throughout, decreasing rapidly after the dry season commenced.

5. The remaining mineral analyses indicate that our natural grasses suffer from a decided deficiency, but that this deficiency, though not so pronounced in the early part of the season, becomes extremely so in most instances from the month of March onwards.

Further, by a system of close-grazing, the total mineral content steadily increases up to at least the month of April.

6. Ether extract is consistently low and crude fibre very high, but the latter lowers steadily under a close-grazing practice.

7. The nutritive ratio of the mature herbage widens from 1: 11.4 at the height of the growing season in January to the appalling ratio of 1: 53.4 in October, the average from May to November being 1: 48.8.

On the other hand, the close-grazed quadrats show an average of 1: 10, the ratio narrowing to the useful one of 1: 7.3 in March.

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CRUICKSHANK, E. M. *Journ. Agric. Sci.*, Vol. XVI., Part I.

FARMING CALENDAR.

September.

BEE-KEEPING.

This is an important month for the bee-keeper, as it starts the first flow of the season. All hives that were sent into winter quarters on a double brood chamber, or otherwise with ample food for that period, should now be overflowing with young in all stages and with a population large enough to take full advantage of the flow. All hives should be carefully examined now and again, entrances opened out to suit the advancing warmth of the weather, and where necessary ventilator lids replaced on the top crates under the hive lid. See that no worry is caused to the bees by ants getting up, and that ample stores of good water (with a pinch of salt and a dash of vinegar) are available for drinking purposes, of which bees consume quite a lot. Swarms can now be looked for; if not required, they can best be destroyed by carbon bisulphide or calcium cyanide—both requiring very careful handling. If it is wanted to increase the apiary, as soon as the scouts are seen looking round for a home, get the decoy hive ready filled with dummy and proper frames of full foundation sheets, or, better still, if they are available, old drawn out brood combs, and as soon as it is taken possession of, insert if possible a frame or two of unsealed brood. As a rule the swarm will settle down at once. Such a colony is best placed in the apiary the same evening, if it can be so arranged. Do not make the mistake so often seen of supplying the new colony with starter frames only; give them full foundation sheets; it pays every time, and more especially so in the first early honey flow. Be sure also and protect the apiary against that persistent robber, the honey bear or ratel, by fencing it with fowl netting and pegging that down with wooden pegs every two feet. The two-footed robber can be just as effectively dealt with by placing a small light chain round the entire hive fastened with small staples and a padlock.

CITRUS FRUITS.

The fate of the citrus fruit crop is dependent upon the treatment the trees receive during this month. If the trees have been given the treatment recommended in the August calendar, and this treatment is followed by good irrigations and cultivation, a good crop of fruit may be expected, whereas a total failure will be the result if the trees suffer for want of moisture at this season of the year.

If not already done, all top worked trees should be headed back early in the month. This cutting back will induce the dormant buds (set in autumn) to commence growth. As the new shoots develop the old tops may be further shortened back until the old top is displaced with a new but profitable one.

The packing of late varieties must be speeded up and completed, if possible, by the end of the month, as the late picked fruit is likely to deteriorate in quality or come into competition with Mediterranean fruits.

All adventitious shoots (water shoots and suckers) must be cut off as they appear, and this work should be continued throughout the growing season.

CROPS.

Utilise your labour to the fullest extent for stumping and clearing more land for mixed crops and for general farm development. Do not be satisfied unless each year sees more profit-earning development work effected. Good organisation of the farm work will permit of much being done without great cost. Begin marking out holes for hand check-row planting of maize, and apply manure or fertiliser. Fertilisers which are to be broadcasted and ploughed or harrowed in can be applied. Do not forget that lands which have been green manured in March or April will require a second ploughing about this date or before being seeded to crops. Early varieties of winter cereals ripen this month and require harvesting. Danger from frost should be past now, and crops susceptible to frost, such as potatoes, onions in beds for the summer crop and Jerusalem artichokes, may be planted where lands are moist. Pumpkins and early maize may be planted on vlei lands. Edible canna may be planted "dry" during the latter half of this month, where some rains may be expected during next month. Overhaul all implements and replace worn parts. Putting this off till the planting season may mean serious loss of planting opportunities between rains. Get out the planters and seed drills. Overhaul and place them in proper working order. Ploughing and cross-ploughing should be hurried on with; also the ploughing under of farmyard manure. A spiked roller can usefully be employed for breaking down clods, particularly on those lands which are to be planted first. Make every effort to secure as good a seed-bed as possible; good seed-beds mean good stands, and good stands are all-important in securing good yields.

DAIRYING.

This is generally the quietest month of the year from a dairying standpoint. Most farmers have by this time exhausted their supplies of winter feed and the production of dairy products is consequently at its minimum. Town milk supplies are now falling off, and a greater use of purchased concentrates in the form of ground nut cake and bran is advisable to keep up the milk supply. Very little cheese is made during this month and stocks are naturally low. Old cheese should be cleared out of the storeroom before the advent of hot weather, and if possible should be sent to be stored under cold storage conditions. Considerable difficulty is to be expected in making butter during this month, as the early spring grass is shooting in the vleis and the butter is consequently very soft. To counteract this, greater use should be made of cotton seed cake, of which a small supply is expected to be available this season.

DECIDUOUS FRUITS.

Newly planted trees must not be permitted to become too dry; watering by hand or gravitation must be continued until the rains commence. Ten gallons of water every fourteen days is sufficient for young trees; these applications should be followed by the loosening of the soil to prevent undue evaporation of the added moisture.

All undesirable growths on the stem and in the centre of the trees should be suppressed as they appear; this will enable the retained shoots to develop normally.

Early fruits must be thinned out this month; only retain two or three fruits on each bearing twig or shoot. Those that are left will then develop into large and attractive fruits.

ENTOMOLOGICAL.

Cotton.—Prevention for most of the boll-worms will be the proper preparation of the ground, with thorough cultivation and eradication of all weeds on the land, particularly those of the family Hibiscus. Wild host plants for stainers should be sought out and destroyed.

Tobacco.—Young plants in seed-beds may suffer from cutworms. Frequent cultivation and laying down of poisoned bait—50 lbs. bran and

21 lbs. Paris green; bring to consistency of a stiff dough, adding water when necessary. Distribute this over the seed-beds in the forenoon, as the cutworm does most of its feeding at night. The beds should be thoroughly burnt over with wood or dry tobacco stalks to ensure that the seed-beds are free from cutworms, and baiting for any coming in from the surrounding ground should then be resorted to when the plants appear. Clear the ground for some distance round the beds, say 30 yards in all directions, and bait this ground thoroughly before sowing—this clearance allows a wide margin over which the cutworms would have to travel. Cutworms' moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night; this should be seen to each evening.

Potato.—Early potatoes are liable to suffer from caterpillars. The crop should be sprayed at first sign of injury with an arsenical wash.

Cabbage.—During this month the most prominent enemies of plants of this family are diamond-back moth and web-worm. Cabbage louse is sometimes troublesome. The young plants may be sprayed or dusted with an arsenical compound for the former, and sprayed with tobacco wash and soap for the latter.

Beans.—Planted under irrigation during September usually escape serious infestation with stem maggot.

Citrus.—Throughout the month lime-sulphur spray (1-100) may be used to control yellow citrus thrip whilst on very young fruit. A useful spray against black aphis and thrip is the following:—Nicotine, 9 ozs.; Capex spreader, 7 ozs.; water, 100 gallons; Capex lime-sulphur, 1 gallon. This may be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine, tobacco wash or Derris.

FLOWER GARDEN.

Cultivate extensively to prevent evaporation and to keep weeds in check. Water plants newly set out, especially such as have their roots near the surface. Thin and regulate growing shoots on roses and various shrubs. Plant out cannas and chrysanthemums (for massing and border decorations) and other herbaceous plants.

VEGETABLE GARDEN.

Sow French beans, leek, spinach, cucumber, egg plant, celery, rhubarb, melons and tomatoes. Small sowings of peas, turnips, beet, lettuce, radish, carrot, parsnip and cabbage may be made now.

FORESTRY.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. Preliminary sowings of eucalypt seeds should now be made on a small scale, so that transplants will be ready in case the first half of the rainy season should prove favourable; otherwise, bulk sowings should be postponed to October-November.

GENERAL.

Indigenous labour is apt to become more scarce at this time of the year, the boys returning to their kraals to break up the land for next season. Stock are liable to stray in search of the young grass now coming up, and much trouble from this cause is to be looked for on unfenced farms. Natives are now cultivating their gardens preparatory to sowing their crops, which they do much earlier than do Europeans. The mischief caused by veld burning becomes apparent from this time onwards in the condition of the stock, and it is necessary frequently to move them away in search of grazing.

POULTRY.

The supply of green food to the birds must be kept up; in fact, during the hot weather they require more.

During our dry season the available supply of such green foods as lettuces, cabbages, sunflower leaves is much reduced, but there are many others that can be used, such as belhambra, plumbago, wild cockscomb, plantain leaves, paw-paw leaves, etc. Sprouted oats, barley and wheat should also be used. Many of the young cockerels should now be fit for killing. Keep the best and get rid of the remainder. It is very advisable to caponise all young cockerels when about 2½ lbs. weight. The "Rhodesia Agricultural Journal" of October, 1924, and Bulletin No. 517 give clear and concise details as to the method of performing the operation. Some of the earliest hatched young pullets will show signs of commencing to lay now. No light breed bird should lay until it is 5 to 5½ months old, or a heavy breed until it is 6 to 6½ months old. Should any show signs of commencing to lay before this, they should be moved from run to run to prevent their doing so. A bird that lays before it is fully matured will stop growing, will always be small, and its eggs will for its first year of laying also be small.

When the pullets are four months old, i.e., those of the light breeds, they should be put into their permanent laying quarters, and those of the heavy breeds when they are five months old. A bird that is moved after it has started to lay will stop and very probably go into a moult.

See that young ducklings get plenty of shade during the hot weather. Those destined for killing should not be allowed free range or even a medium-sized run, but should be kept fairly crowded in small runs. It is necessary to get the flesh on them as quickly as possible, and the more rest and less exercise they have, the more rapid will be the growth, and also more succulent and tender the flesh.

The hatching of turkeys should proceed rapidly and be carried on until the end of the dry season. See that they have plenty of chopped onions or onion tops or eschalots, and thick separated milk. These are absolutely necessary if the turkey breeder wishes to be successful with his rearing. Do not give wet food; dry mash such as given to chickens is the better.

STOCK.

Cattle.—Ranching cattle should require little now in a normal season; it is only in the event of very late rains that trouble should be expected. Where possible, it will be wise to keep an eye on those cows that may be expected to calve early, with a view to feeding them if necessary and seeing that they do not get too poor. The supplementary feeding of ranch stock is always a difficult problem. But a small provision of cotton seed, good veld hay, kaffir corn or sunflower silage at this time may be the means of saving many head of cattle when the rains are late. This is a critical month for young stock. Weaning should be completed as soon as conditions permit. The dairyman will carry on much as in August; he will, however, use his discretion (in accordance with the condition of his veld) as to the use of ensilage, pumpkins or other bulky and succulent food. He will be wise not to shorten the supply of concentrated foods for some time to come. A little hay or ensilage should still be kept in reserve until the rains have fallen in reasonable abundance. The object should be to build up the condition of the cows expected to calve when the rains come.

Sheep.—The remarks for August apply. Feed up and shear the rams ready for mating for winter lambs.

TOBACCO.

Hasten the preparation of seed-beds for flue cured type of tobacco. The first batch of beds should be seeded about mid-September; subsequent

seeding of the remaining seed-beds should be done (in batches) at fortnightly intervals. The last lot of beds normally is sown by the end of October. Seed-beds for dark fire cured type of tobacco should be prepared for seeding which commences after the first week in October.

VETERINARY.

There should be very few deaths from redwater and gallsickness this month. Cases of vegetable poisoning of stock picking up tempting young green shoots of dangerous character on the burnt veld are of frequent occurrence. Sheep can be inoculated against blue tongue, but ewes in lamb should not be treated, on account of the danger of abortion. Scab may be prevalent.

WEATHER.

The temperature may be expected to rise steadily during this month. Rains are not due until next month, though the average over a period of years shows slightly more than in the previous four months, and ranges between .1 and .5 inch. Frost has been known to occur in September, although this is a very unusual event. Rain-gauges should be seen to before the rains commence. They should be carefully adjusted to stand exactly level with the lip four feet above ground, and care should be taken that no tree, building or other obstruction interferes with the fair precipitation of rain into the orifice.

October.

BEE-KEEPING.

Bush bloom is now on, the queens consequently are laying vigorously, therefore give space and ventilation. In good districts, where stocks are strong, nectar may be coming in freely, and to prevent swarming it may be necessary to remove a crate of honey. By using the carbolic cloth, the operation is easily and quickly accomplished. At this season, whenever a crate of honey is removed, a properly fitted empty crate must take its place, otherwise the bees will swarm. Keep the apiary clear of weeds, and all hives well shaded. Feed any weak stocks.

CITRUS FRUITS.

Citrus trees should not be permitted to suffer for want of water if a good setting of fruit is desired. Continue irrigation at fairly frequent intervals, especially if it is windy. Cultivation must follow each irrigation when the soil is fit to work, otherwise a large amount of moisture will be lost by evaporation. The packing of late fruit for export should be completed early in the month or before the rains commence. If rains intervene, the carrying properties will be affected and the fruit will probably break down in transit. Suppress all stem growths or water shoots as they appear. Young trees planted last season may with advantage have the stems whitewashed or washed with Bordeaux mixture paste; this will prevent undue sun-scalding of the unprotected stems. Plant cover crops with the first good rains.

CROPS.

If not already attended to, overhaul all farming implements and replace worn parts to ensure efficiency. Shell ground nuts required for the season's planting. Ploughing of old lands should, at latest, be finished this month. If seed potatoes will not keep in good condition until next month, they may be planted now, but later planting is better. Edible

canna may be planted this month before rain falls. Also velvet beans, dolichos beans and sunn hemp towards the end of the month for green manuring. Harvest winter cereals and plough under the stubbles as soon as possible after harvest. When rains have fallen, use every effort to improve the tilth of the lands which will be the first to be planted. On cloddy lands already ploughed, seize the opportunity to break down the clods by disc and drag harrowing as showers of rain fall. A spiked roller is very useful for this work. A good tilth means good planting, and a good stand of maize; therefore, do everything possible by cross ploughing, disc and drag harrowing to bring the soil into good condition for seeding.

When necessary, keep the harrows going to check early weed growth. Clean lands at this time of year are an insurance against cutworm and other insect pests. If weather conditions permit, plant a trap crop of maize to attract the stalk borer. New land to be ploughed and intended for planting this season should be cleared of heavy grass or weeds by burning or cutting to ensure good work being done by the ploughs. Seasonal showers of rain are liable to spoil bricks unburned. See that bricks which have been made are protected from rain. Clean out guttering and down-spouts of house and farm buildings. Press on with development work so as to have this completed before rains break.

DAIRYING.

During the month of October and until such time as the rains have commenced and green grazing is available, dairy stock require to be almost entirely stall fed. Cows in milk and cows due to calve should be liberally fed on succulents and concentrates in order that they may commence the dairying season in good condition, and make full use of the early grazing for milk production. Dairy cows that are underfed at this time of the year invariably produce milk of poor quality, and usually throw weedy undersized calves; furthermore, they do not pick up in condition until comparatively late in the season.

During October, the cow's ration should consist of succulents such as silage or green feed, etc., legume hay of good quality and a liberal allowance of concentrates; a pound or so of a feed such as ground-nut cake is invaluable for dairy stock at this time of the year.

Weather conditions are generally fairly warm during the month of October, and every precaution should be taken to keep the cream, which is used for butter-making or which is sent to the creamery, as cool as possible. The can or bucket containing the cream should be placed in a basin of water or concrete trough, in the dairy, and exposed to a draught; a piece of kaffir blanket, which dips into the water, should be wrapped around the can or bucket containing the cream. Churning of cream for butter-making is best carried out early in the morning—before sunrise if possible; the coolest water obtainable should be used for washing the butter whilst in the granular stage.

At this season of the year cheese-makers may find that the milk is deficient in butter fat; this is generally the result of under-feeding or unsuitable feeding. Cheese made from milk of low fat content is invariably dry and hard, defects that are accentuated by over cooking the curd or by cooking at too high a temperature. The curd should be firmed in the whey at a temperature not higher than 98° F. to 100° F.

DECIDUOUS FRUITS.

Keep all trees well watered until the rains commence; cultivate after each watering to prevent evaporation of added moisture. Rub off all undesirable shoots, such as those arising on the main stem near the ground; also those shoots having a tendency to crowd each other. Two or more shoots should not be allowed to develop from the same spot on any part of the tree. Rub off the weaker ones soon after they appear. The fruit of early peach trees should be thinned out if a heavy crop has

set; this thinning will result in a crop of large-sized fruit. All fruit should be thinned out if necessary.

ENTOMOLOGICAL.

Maize.—Where circumstances permit early growth of maize, crops planted late in October are liable to suffer in December from stalk-borer, especially if only a few acres are involved. If maize can be planted early in October, the plants are usually large enough by December to outgrow serious damage. Maize beetle is now in its pupal stage. Thorough working and smashing up of the soil at this time will destroy great numbers.

Tobacco.—See notes for last month, together with article in the "Rhodesia Agricultural Journal" for October, 1926, on "Baiting of Tobacco Seed Beds with Cyanogas Calcium Cyanide." The lands must be kept free from all weeds which caterpillars may feed on, and it is well not to have maize, tomato and Cape gooseberries near the lands; a clearing of some depth is advisable, which must be regularly weeded. If poisoned bait is put down, it has been found that a covering of sacking or leaves will help to retain moisture and thus give further attraction, especially at this time of the year. In order to lessen the heavy infestation of caterpillars and other insect pests in the seed beds, coverings of hessian or cheese cloth should be kept over beds, especially at night; cutworm moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night. Notwithstanding precautions in the covering of the beds, insects will enter, and after the emergence of the seedlings a weekly spraying should be carried out. Lead arsenate at the rate of 1½ ozs. (powder) or 3 ozs. (paste) in a 4-gallon petrol tin can be sprayed on the plants once a week to keep insect pests in check. Lead arsenate can be safely used with Bordeaux mixture, the constituents not reacting upon one another. The two combined sprays act as a preventative and deterrent to insect and fungoid troubles.

Cotton.—Thorough cultivation and keeping down of weeds should be resorted to in order to lessen the infestation of over-wintering pupæ, by exposure to the sun, and birds.

Potato.—Avoid introducing root gallworm and potato diseases to valuable land under irrigation or to the home garden with seed potatoes. Growing plants in October may be defoliated by caterpillars, or the tops severely injured by the potato tuber moth. Spray with arsenate of lead (powder), 1 lb. to 30 gallons of water; or (paste), 1 lb. to 16 gallons of water.

Cabbage, Turnip, etc., are apt to suffer severely from diamond back moth and webworm. Dust regularly with Paris green, 1 lb.; fresh water-slaked lime, 20 lbs. For cabbage aphis, water liberally, and wash plants regularly with a forceful stream of water from a hose or spray pump.

Beans and Peas are little attacked by insects at this time of year. If aphis (green fly) is troublesome, the plants may be sprayed with soap wash or tobacco wash. Leaf-eating beetles are best destroyed by hand.

Cucumbers, Marrows, etc., may be attacked by leaf-eating beetles, which quickly destroy the young plants. The young plants may be protected by gauze covers. Once vigorous growth has started, the damage is negligible.

Citrus.—All out-of-season fruit should be removed by this time. Destroy all fruit "struck" by the false codling moth. Aphis may be controlled by very careful spraying with the combined "Lime-Sulphur-Nicotine" spray (for details see "Rhodesia Agricultural Journal," Sept., 1926, page 871), while the yellow thrip may also be kept in check by this spray. Avoid using miscible oils for citrus spraying. A careful search should be made for the American bollworm ("Heliothis obsoleta").

Deciduous Fruit Trees, including grape vines, are liable to attack by chafer beetles. Heavy spraying with lead arsenate (paste), 1 lb. to 10

gallons of water, or (powder), 1 lb. to 20 gallons, appears to afford considerable protection, but the leaves need thoroughly coating.

Fig.—Fruit infested with fig weevil should be collected regularly and destroyed.

FLOWER GARDEN.

All flower seeds, annual and perennial, may be sown as in September. A word or two on open seed beds may not be out of place here. These beds should be prepared in a sheltered position, and the soil should be well and deeply dug. This is most essential, as in this state the soil when once watered is more easily kept moist, and is not so liable to cake. The top dressing should be free from all undecayed vegetable matter, and when sown, the seeds should be covered with a thin dressing of fine light soil, over which a thin covering of grass may be placed to check evaporation. Transplanting from boxes or beds should be done on a dull day or towards evening; the plants should be well watered before being removed, and the roots disturbed as little as possible, care being taken that the latter have their full depth and spread when planting.

VEGETABLE GARDEN.

As in September, nearly all vegetable seeds may be sown. Early potatoes should be earthed up when reaching the height of about eight inches. In planting a small amount of marrow, melon, cucumber, and pumpkin, the writer has found it economical to sow the seed one in a tin and transplant when about four inches high in hills. A few cucumbers planted in this manner yielded nearly 400 a week for about two months. Sweet corn and maize may also be sown this month.

FORESTRY.

The main sowings of Eucalypt (gum) seed should be made either in seed trays or in well prepared seed beds. A well-broken soil forming a fine tilth in the seed bed ensures more successful germination and better plants. If transplants are being used, any seedlings which are ready should be pricked out.

Seedlings in open beds may have their tap roots cut so as to develop fibrous lateral roots, and thus produce good type stocky plants. Remember the plant feeds through its roots, hence the better the root system, the healthier the plant and the greater its chances of successful establishment. If conditions are favourable, cross-plough and harrow land for planting broken up in early autumn.

POULTRY.

October is usually a hot month, and poultry keepers should therefore see that their birds have access to shade during the day. At the same time they should have plenty of air. One often sees birds during hot weather sitting under dense bushes, which is almost worse than no shade at all.

All houses should be examined and, if necessary, repaired. It is advisable to repeat the caution that birds must have dry quarters.

Many poultry keepers do not realise the vital necessity of giving their birds especially the young stock, plenty of succulent green food during the hot weather. It should be cut up and placed in boxes or hoppers about 7.30 a.m. and 5 p.m., and, if very hot, also at noon; it should never be placed in the sun. As much as the birds will eat should be supplied. Lack of it, especially during hot weather, causes a reduced output of eggs, smaller eggs and light-coloured yolks; further, a disease known as "nutritional disease" is likely to affect the birds and cause deaths. The symptoms are much like those of eye roup, without the well-known offensive smell of roup. It is due to the fact that vitamine A, which is present in large amounts in all succulent green foods, and which is so necessary for nutrition, is lacking. There is no doubt that many chickens and fowls die each year from this cause.

Ducks.—These during the hot weather require even more shade than do fowls; they cannot stand the direct rays of the sun nor sultry heat. The houses should always have dry floors, and should be overhauled before the rains commence. Ducks sleeping on damp floors often contract rheumatism and cramp. The floor of the duck house should be raised a few inches, thus ensuring a dry bed.

As many ducklings should be hatched as possible now, provided, of course, there is the prospect of a sale for them at ten weeks old. They thrive best in the wet weather.

Turkeys.—Stop hatching until after the wet season is over. To rear turkeys in the wet weather entails a good deal of time, labour, expense and often losses. Once a young turkey chick gets wet, it will probably die; at any rate it will never be the same bird it would have been had it not got wet. Give the older turkeys all the range possible; the further afield they go, the better grown birds they become, and less is the expense of feeding. See also that their roosting quarters are water-tight before the rains commence.

STOCK.

Cattle.—Ranching cattle on granite veld will in many instances be in fairly good condition on account of the early grass in the vleis, etc. On the diorite soils and later veld the cattle owner will still have to watch his weaker cattle carefully. In any case all supplies of hay, ensilage, majordas, etc., should be carefully husbanded in anticipation of possible late rains, but at the same time every effort should be made to prevent cattle becoming weak. Dairymen will need to feed highly both with succulents and green foods. Calves should be weaned and branded if this has not already been done, and care should be taken that they do not suffer any serious setback by reason of want of feed. The question of a mineral mixture should receive consideration.

Sheep.—If spring lambs are expected, one should see that the sheep-shed is in order, and that there is a supply of hay, ensilage or mealies for the poorer ewes in the event of late rains. All drinking places should be cleaned out, and care taken that the water supply is sufficient. Ewes for winter lambing should be well looked after, so as to get them up in condition before they are put to the ram next month. General shearing may start, including the April-May lambs.

TOBACCO.

Continue to sow seed beds. Where grass has been put on the seed beds to assist germination of seed a daily inspection should be made, and as soon as the first few plants make their appearance the grass should be raised up a little from the bed in order to prevent the plants growing "spindley." All possible preparation for the coming planting season should be made.

VETERINARY.

White scour is prevalent in spring—November and December—but dipping is eradicating this disease. There is still danger from vegetable poisoning, and it will only disappear when there is plenty of good grass on the veld.

WEATHER.

This is apt to be a hot, dry month, and rather trying, therefore, to man and beast, and the strong winds which blow at this season add to the general discomfort. Evaporation is, as a consequence, at its greatest at this time of year, and dams and pools lose most from this cause. The prevalence of veld fires at this time of year adds to the anxiety of the stock owner.

The rainy season has occasionally started early in October, but for practical purposes it need not be expected before the end of this month. The days are becoming warmer, and often even hot and oppressive. Clouds gradually collect, at first disappearing at sunset, but later becoming more persistent. Sheet lightning is usually frequent, and showers of gradually

increasing severity mark that the rainy season has set in. Steps should be taken in advance to provide for the run-off after such torrential rains, otherwise serious loss may result.

The normal rainfall varies from three-quarters of an inch to an inch in the different portions of the country. The rain usually occurs in the form of thunder-showers, which are not long sustained and are fairly local, but the total rainfall experienced during the month does not vary much over the whole country, with the exception of the eastern border, where the rainfall is usually heavier.

SOUTHERN RHODESIA VETERINARY REPORT.

June, 1932.

AFRICAN COAST FEVER.

Melsetter District.

Commonage.—One case of disease occurred. All cattle were moved to clean veld on the south-western section of the Commonage.

Sawerombi.—No further cases.

Orange Grove.—On 14th June one case of Coast Fever was diagnosed in the herd running on this farm. This was the first case of disease amongst these cattle, although they had been grazing in the vicinity of the infected Roede herd and dipped at the same tank on Orange Grove Annexe. On the 21st the herd was moved to a temperature camp on Welgelegen.

Rocklands Estate.—The process of moving the infected herds through temperature camps to clean veld was continued. The total mortality from Coast Fever during the month was 315 head.

To test a common belief that inoculation with bile was a "cure" for coast fever 21 head were treated: all died.

Laughing Waters.—Twenty-one days after the removal of this herd to what was considered clean veld one beast showed a high temperature with Kochs bodies in gland smears, indicating that the veld was infected. Arrangements were made for a further removal and temperaturing.

Newcastle.—The temperaturing of the herds on clean veld was completed. No cases suspicious of coast fever were detected.

Glencoe.—No further cases.

FOOT AND MOUTH DISEASE.

Gwelo Veterinary District.

The inoculation of all cattle on Ghoko Block was completed on 7th June.

A fresh outbreak occurred on the farm Pender adjoining Ghoko Block, and the herd was inoculated immediately.

The cattle concentrated on Aberfoyle Block for inoculation were permitted to return to their respective farms and kraals.

Umvuma Veterinary District.

No fresh outbreaks. It was decided to inoculate all cattle on the Central Estates and operations were started on 27th June.

Victoria Veterinary District.

No fresh infection occurred during the month.

After the outbreak in the weaner mobs at Headquarters Section, Nuanetsi Ranch, referred to in the report for May, it was decided to inoculate all these mobs in order to get the infection through as quickly as possible and a supply of blood was obtained from the Gwanda area. The following results were observed: In one mob about 30 reacted with visible lesions, and in another 6 showed visible lesions. In the latter 16 calves ranging in age from 2 days to 2 months were temperatured morning and evening, but no thermal reaction was observed. No reactions occurred in the other mobs.

In order to obtain some information about the degree of immunity conferred by the local type of foot and mouth disease 266 transport oxen, which had passed through the original infection in April and May, 1931, were inoculated, and of these 36 head were temperatured morning and evening. In no single instance was any symptom, thermal or otherwise, of foot and mouth disease observed. There can be no doubt as to the virulence of the blood used as the same mixture caused a very high percentage of reactions in clean herds in the area of origin.

BULAWAYO VETERINARY DISTRICT.

In the Belingwe district all previously infected areas have cleared up completely.

In the Gwanda district the cattle concentrated at Oncerbrook and Ladi, having recovered from inoculation, were permitted to return to their kraals.

In the Insiza district the inoculation of cattle at Tshadas tank in the Insiza Reserve and in the Siwazi dipping tank area was completed. An inoculation station was established on Donkerhoek and the remainder of the Donkerhoek cattle, together with cattle moved from River Block, Nyamini and Buffelsfontein were inoculated there. Cattle free belts with strong cordons have been established around all the infected areas. In the eastern section of the Insiza district infection was found on the farm Virginia, due, it was believed, to an illicit movement of cattle from the infected area in Selukwe district. A few kraals in Luttrells Town North and De Beer's Native Location were also found to be infected. A cattle free belt was established around De Beer's Location and Luttrells Town North and all cattle involved concentrated and inoculated.

Since the policy of concentrating and inoculating cattle with the object of limiting the spread of infection the total number of animals so dealt with in this veterinary district is 65,959.

TRYPANOSOMIASIS.

A few cases occurred in the Darwin district and also in the Melsetter district.

HORSESICKNESS.

Only one case reported.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate: Bulls 1, heifers 51, oxen 205, cows 142, horses 36, sheep 1,811, goats 215, pigs 46.

EXPORTATIONS.

Nil.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

PRICE LIST OF FOREST-TREE TRANSPLANTS, ORNAMENTAL TREES AND SHRUBS, HEDGE PLANTS, CREEPERS AND SEEDS,

OBTAINABLE AT THE GOVERNMENT FOREST NURSERY, SALISBURY.

1. Transplants of forest trees, etc., as far as in stock, are obtainable at the subjoined rates.

2. Orders should be addressed to the Chief, Division of Forestry, Salisbury; or Manager, Forest Nursery, Salisbury.

3. **All orders must be accompanied by a remittance in cash, bank note, postal order, draft or cheque, made payable to the Department of Agriculture, Salisbury. Under no circumstances will plants or seeds be sent out or taken away from the Nurseries unless paid for.**

4. All transplants are despatched at Rate 10 on railways at purchaser's risk. The transplants are watered as far as this is possible by the railway staff.

5. All prices quoted are for delivery free at any station or siding in Southern Rhodesia.

6. Purchasers of trees contained in tins either of 25 or 4 trees are requested to return the tins, carriage forward, to the nursery from which they were obtained, or to the Manager, Forest Nursery, Salisbury. If the tins are not returned within two months from date of issue, they will be charged for at the current rate of petrol tins; present price, 4d. each.

7. No trees will be reserved unless specially booked. Orders will be executed in order of receipt as trees are ready for despatch. Every effort will be made to comply with instructions of purchasers.

8. Transplants of forest trees, when quoted at per 1,000, are grown in half paraffin or petrol tins containing 20 to 25 transplants. The average weight of each tin is about 25 lbs. Height of transplants, about 3 to 12 inches.

9. Transplants of larger size, from 1 ft. to 3 ft., are also supplied four in a tin at per tree. Weight of tin, about 25 lbs.

10. Shrubs and ornamental plants in single tins have a weight of about 5 lbs.

11. To purchasers of forest trees, the following reductions are made:—

(a) When the number exceeds 1,000, the price is £3 5s. per 1,000.

(b) When the number exceeds 5,000, the price is £2 14s. per 1,000.

(c) Special quotation for orders over 20,000.

12. Orders for seed are posted or railed free of charge.

13. Though every care is taken to supply trees and seeds true to name and of good quality, no guarantee can be given in this respect, more particularly in regard to seed.

14. Intending tree planters are invited to apply to the Chief, Division of Forestry, Salisbury, for advice as to the most suitable trees for growing in the various climates and soils of the Colony, and on the best methods to adopt in the formation of plantations, wind breaks and shelter belts.

15. No responsibility taken after trees, shrubs, etc., have been accepted by the Railways. Any claim for loss or death should be made to the Railway Company.

Price of Transplants.—For convenience, the following symbols are used to indicate the purchase prices of transplants:—

A—Trees, 25 in tin, at 2s. 3d. per tin, £3 5s. per 1,000; £2 14s. per 1,000 for orders over 5,000.

B—Trees and shrubs, 24 in tin, at 3d. each.

C—Trees and shrubs, 4 in tin, at 4d. each.

D—Trees and shrubs, 4 in tin, at 9d. each.

E—Trees and shrubs at 9d. each; extra large up to 5s. each.

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed. Lb.	Price of seed. Oz.
Callitris calcarata	Black cypress pine ...	Usually rather slow growing, but reaches a fair size and produces a valuable durable softwood. Suited for dry country planting, especially in sandy soil. Resistant to white ants. Good shelter for orchards, etc.	A. C.	15s.	1s.
Callitris robusta	White cypress pine ...	Similar to Callitris calcarata. Better for poor acid soils and ironstone kopjes.	A. C.	15s.	1s.
Casuarina Cunninghamiana	Beefwood	A fine large shade tree, suitable for avenues and narrow belts, but not recommended for timber plantations. Requires deep soil in drier localities. The foliage is useful for stock fodder, and the tree stands lopping well.	A. C.	...	2s. pkt. 1s.
Cedrela odorata		A rapid-growing tree similar to Cedrela toona, but with lighter foliage. Likely to do well on heavy soils, fairly free from frost. 30 to 40 feet in height.	A.		
Cedrela toona	Toona tree	A rapid-growing, handsome, semi-deciduous tree, suited for moister localities where frost is slight. Yields a valuable soft timber. Recommended for plantations, as well as shade and ornament.	A. C.	15s.	1s.
Cupressus arizonica ...	Arizona cypress	A hardy evergreen tree, suitable for dry localities, but requiring a well-drained and rather deep soil. Useful for shelter belts and also for hedges when closely planted.	A. C.	15s.	1s.
Cupressus lusitanica ...	Portuguese cypress ...	A fast-growing cypress, producing an excellent softwood timber, but requires a moist, cool climate and a good soil. May well be used for shelter and hedges in favourable localities.	A. C.	5s.	6d.
Cupressus sempervirens, var. horizontalis	Common spreading cypress	A hardy cypress, suited for limestone as well as other soils. Not so frost or drought hardy as Cupressus arizonica. Suitable for shelter and hedges.	A. C.	15s.	1s.

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed. Lb.	Oz.
Cupressus sempervirens, var. pyramidalis	Common upright cypress	An ornamental tree for gardens and cemeteries. Also useful as a shelter tree. Grows under similar conditions to the "var. horizontalis."	A. C.	15s.	1s.
Cupressus torulosa ...	Himalayan cypress ...	A good tree for timber and shelter. Withstands much cold and drought. Not very soil exacting. Fairly frost-hardy.	A. C.	10s.	9d.
Eucalyptus botryoides	Bangalay	A large-leaved, heavy-foliaged gum. Quick growing. Suitable for granite and red soils. Withstands frosts, but not very drought-resistant.	A.	15s.	1s.
Eucalyptus citriodora ...	Lemon-scented gum ...	A clean-boled tree, producing an excellent timber. Leaves lemon-scented. Suited for wetter regions and on the better soils in the lower rainfall regions. Will not withstand much frost or drought. Flowers prolifically, rendering it very useful for honey production.	A.	15s.	1s.
Eucalyptus crebra	Narrow-leaved iron-bark	A slow-growing, deep-rooting species, producing excellent timber. Suitable for well-drained soils in the higher rainfall areas. Withstands a certain amount of drought and light frosts. Will not thrive in an acid soil.	A.	15s.	1s.
Eucalyptus globulus ...	Tasmanian blue gum	A fast-growing tree, suitable for cool, moist areas with deep soils. Will not withstand drought, but is frost-resistant to a large extent. Produces a useful timber.	A.	15s.	1s.
Eucalyptus maculata ...	Spotted gum	One of the best trees for timber production or shelter in the wetter areas, being fairly hardy to drought but not to frost. Produces an excellent timber.	A.	15s.	1s.

Eucalyptus maideni ...	Maiden's gum	A very fast-growing, large tree, with bluish foliage in youth. Fairly drought and frost resistant. Will grow on poor soils if deep and well-drained. Produces a good, strong, useful timber.	A.	30s.	2s.
Eucalyptus melliodora	Yellow box	A medium-sized tree, useful for shelter belts. Produces a tough, durable timber. Very resistant to drought and frost. Valuable for honey production, having abundant sweet flowers.	A.	15s.	1s.
Eucalyptus paniculata	Grey ironbark	A very good timber tree, with heavy foliage. Suitable for the moister regions, with a deep, fertile soil. Withstands some drought, but is frost-tender. Yields an excellent, hard, durable wood.	A.	15s.	1s.
Eucalyptus punctata ...	Leather jacket	A tree of fair size, yielding a good, durable timber. Adaptable as regards soil and climate, but will not withstand a dry, cold climate.	A.	15s.	1s.
Eucalyptus robusta ...	Swamp mahogany ...	A quick-growing, shady tree, which requires a moist soil for best results, but will grow under fairly dry conditions, provided frost is not severe. Recommended rather for shelter belts than plantations.	A.	15s.	1s.
Eucalyptus rostrata ...	Red gum	Produces an excellent and durable hardwood. Withstands drought, heat, brak, flooding and a good deal of frost. One of the best species for planting in Southern Rhodesia, except in sour soil and wet mountain regions.	A.	15s.	1s.
Eucalyptus saligna ...	Sydney blue gum ...	A fast-growing, useful tree, producing a useful medium hardwood. Thrives on deep, fertile soils in the heavier rainfall areas. Tender to frost and drought.	A.	15s.	1s.
Eucalyptus sideroxylon	Red ironbark	A fairly slow-growing species, suitable for dry, rocky soils in the moister regions. Produces a good, durable hardwood.	A.	15s.	1s.
Eucalyptus tereticornis	Forest red gum	Similar to Eucalyptus rostrata, and can be planted along with it, except in areas liable to flooding and great heat. Perhaps not quite as drought-resistant.	A.	15s.	1s.

Botanical Name.	Common Name.	Remarks.	Price of transplants.	Price of seed. Lb.	Price of seed. Oz.
Grevillea robusta	Silky oak	A handsome tree which thrives best in moist, warm localities. Useful for ornament, shade and timber. Frost-tender and not resistant to drought. If the locality is unsuitable, it may grow well for several years and then die out.	A. C.	...	pkt. 1s.
Jacaranda mimosaefolia	Jacaranda	An ornamental tree with feathery foliage and abundant blue flowers, which appear in spring. Best development is attained in the moister regions, but the tree withstands drought to a surprising extent, and may be planted in the drier regions if the soil is reasonably deep and fertile. It is tender to cold and frost, and may need protection in its earlier youth. Semi-deciduous.	A. C.	20s.	1s. 3d. pkt. 1s.
Pinus canariensis	Canary Island Pine ...	Hardy to drought, but not to severe frost. Best suited for planting on higher altitudes and in higher rainfall areas. Slow growth in early youth, then more rapid in later years. A handsome tree with inverted, umbrella-like branches, not spreading. Yields an excellent softwood timber.	A. C.	15s.	1s.
Pinus halepensis	Aleppo pine	A drought-resistant pine which will grow on limestone and shale soils. Not recommended for plantations, but can be used for shelter and ornamental purposes in the drier regions.	A. C.	15s.	1s.
Pinus radiata (insignis)	Remarkable pine ...	A large tree of very rapid growth, producing a useful softwood. Most at home in the heavier rainfall areas. Does not like sour or poorly-drained soils. Frost-hardy but not drought-resistant, usually failing at an early age in the drier regions.	A. C.	15s.	1s.
Pinus longifolia	Chir pine	A somewhat slow-growing pine, but useful to plant in localities where the climate and soil are doubtful at the higher elevations. For timber and ornamental purposes. Not frost-resistant or very drought-hardy.	A. C.	15s.	1s.

Pinus pinaster	Cluster pine	Yields a useful, strong softwood. Does well on sandy soils and soils without much lime, in the better rainfall areas. Not very drought-resistant.	A. C.	15s.	1s.
Populus alba	White poplar	A rapid-growing poplar, requiring a good, deep soil in close proximity to running water. Propagated by suckers. Deciduous.	Suckers at 9s. per 100		
Populus deltoidea, var. missouriensis	Carolina poplar	A very fast-growing poplar, producing a very good timber for matches, etc. Requires a rich, moist, alluvial soil. Moderately frost-hardy. Does not like stagnant water.	C.		
Salix babylonica	Weeping willow	A useful timber and ornamental tree, requiring a moist, well-drained soil which is occasionally flooded. Not suited for ground in which water is stagnant.	C.		
		Ornamental Trees, Shrubs and Hedge Plants.			
Abelia floribunda	—	A shrub with myrtle-like leaves, evergreen if watered. Pink-white flowers in profusion. Is used for hedges in Natal.	E.		
Aberia caffra	Kei apple	A rough, thorny, impenetrable shrub, making a good hedge. Withstands frost and drought well. Suited for all but the driest areas of the Colony. More useful than ornamental. Slow growing.	B. E.		
Abutilon chinensis ...	Chinese lantern	An ornamental shrub, with orange-coloured flowers, requiring a heavy pruning about the fourth year.	E.		
Acacia Baileyana	Silver wattle	A small ornamental tree with blue foliage and yellow flowers.	E.		
Acalypha marginata ...	—	Margin of leaf crimson: a shrub: will grow to 10 feet in height, or clipped to shape. Very useful to give colour to shrubbery.	E.		
Agapanthus umbelatus	Cape Lily	Blue and white varieties.	E.		
Aleurites fordii	Tung oil	An important oil-bearing tree from China. 25 to 30 feet in height.	E.		

Botanical Name.	Common Name.	Remarks.	Price of transplants.	Price of seed. Lb.	Price of seed. Oz.
Aloysia citriodora	Lemon-scented verbena	A small shrub with a strongly lemon-scented foliage. Hardy, vigorous, quick-growing.	E.		
Alstonia scholaris		A white flowered shrub, 6 feet high, similar to Oleander.	E.		
Bauhinia galpini	Pride of de Kaap ...	A rambling shrub, bearing orange-red flowers. Hardy.	D. E.	...	pkt. 1s.
Bauhina acuminata ...	Bauhinia	A large, indigenous shrub, flowering profusely in early spring. White flowers. Hardy.	D. E.	...	pkt. 1s.
Bauhinia purpurea ...	Bauhinia	Similar to the Bauhinia acuminata, but with mauve flowers. Hardy.	D. E.	...	pkt. 1s.
Bolusanthus speciosus	Rhodesian tree wistaria	An indigenous, deciduous tree with blue flowers at the end of long stalks. Ornamental.	E.		
Brugmansia Knightii ...	Moonflower	A flowering shrub with large, drooping, white flowers. Strong scent (cf lily). Fairly frost-hardy.	E.		
Buddleia sp.	Blue buddleia	A medium-sized shrub with sweet-scented blue flowers. Useful as a hedge. Rapid-growing, but frost-tender.	E.		
Buddleia sp.	Yellow buddleia	A rank-growing, yellow-flowering shrub. Useful as a hedge. Rapid-growing. Frost-tender.	E.		
Callistemon speciosus ...	Bottlebrush	A scarlet-flowering shrub of drooping habit. Makes an excellent hedge if trimmed along the top only.	A.C.E.	...	2s. pkt. 1s.
Carica papaya	Pawpaw	A small tree with a large, dark green foliage, bearing large edible fruits.	E.		
Casimiroa edulis	Mexican apple	A large, rapid-growing tree, 30-40 feet in height, evergreen, and bears a delicious fruit. A fine shade tree.	E.		
Cassia capensis	Cape laburnum	A rapid-growing shrub, bearing masses of bright yellow flowers.	E.		
Cestrum aurantiacum ...	Ink berry	A small shrub, bearing orange flowers in profusion.	E.		

Cinnamomum camphora	Camphor	A somewhat slow-growing, ornamental, evergreen tree, with camphor-scented foliage. It requires a deep soil in the higher rainfall zones.	D.	
Crataegus oxyacantha	Hawthorn	Fruits yellow. Deciduous shrub. The yellow berries hang throughout the winter.	E.	
Crataegus pyracantha ...	Hawthorn	Berries scarlet. Shrub evergreen if watered throughout the winter.	E.	
Croton sylvaticus	Mount Selinda linden	A large-leaved, deciduous tree from Melsetter.	E.	
Cyphomandra betacea ...	Tree tomato	The well-known tree tomato. Will grow anywhere where Paw Paws will thrive.	E.	
Dahlia imperialis	Tree dahlia	A medium-sized shrub, making a handsome show with its single white blooms.	E.	... pkt. 1s.
Dalbergia sissoo	Sissoo	A large deciduous tree from India, producing an excellent timber. Desires a deep, porous, well-drained soil in close proximity to running water. Will not tolerate stiff clay. Frost-hardy, but not very drought-resistant. Rapid-growing.	D.	
Datura arborea	Tree tomato	A large shrubby tree, up to 30 feet in height, with large purple flowers. Very quick grower.	E.	
Deutzia crenata	Bridal wreath	A small deciduous shrub with double white flowers, tinged slightly pink, on long, drooping stalks.	E.	
Duranta plumieri	Tree forget-me-not ...	A medium-sized, deciduous shrub with blue flowers. Useful as a hedge. Very hardy.	E.	
Eugenia braziliensis ...	Brazilian cherry	A small shrub, bearing orange-coloured, edible fruits. A useful hedge plant.	D.	
Euphorbia splendens ...	Christ thorn	A small thorny shrub with bright scarlet flowers. Suitable for low hedges and borders.	E.	
Freylinia tropica	Inyanga hedge plant	A useful hedge shrub. Indigenous.	B.	
Gardenia florida	Katjepeering	A compact, evergreen shrub with dark green, glossy leaves and pure white, sweetly-scented double flowers.	E.	

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed. Lb.	Oz.
Gerbera Jamesonii ...	Barberton daisy	Hybrids.	3s. 6d. per doz.		
Hamelia patens	...	A compact shrub 8 feet to 10 feet in height, flower orange-yellow tubes, a showy shrub.	E.		
Heliotropium peruvianum	Heliotrope	A small shrub with sweet-scented lilac or nearly white flowers. Suitable in flower border.	E.		
Hibiscus rosa-sinensis ...	Chinese rose	Evergreen shrub with numerous scarlet flowers. Double and single varieties.	E.		
Hibiscus syriacus	Christmas rose	A shrub of which there are single and double varieties with white flowers.	E.		
Holmskioldia sanguinea	Holmskioldia	A fairly hardy shrub, bearing a profusion of brick-red flowers in large bunches. Suitable for hedges.	E.		
Holmskioldia sp.	Holmskioldia	A yellow-flowering, handsome shrub similar to Holmskioldia sanguinea.	E.		
Hydrangea japonica ...	...	A well-known shrub. The flowers are naturally pink, and are changed to blue by feeding the plants with small quantities of Nitrate of Soda, as they grow.	E.		
Hypericum lanceolatum	St. John's wart ...	A small, yellow-flowering shrub. Multitudes of flowers.	E.		
Iboza riparia	Rhodesia spirea	A blue-flowered shrub, indigenous to the Colony. 6 feet to 8 feet in height.	E.		
Iochroma tubulosa ...	Iochroma	A shrub with dark blue flowers.	E.		
Iochroma sp.	Iochroma	A shrub with scarlet flowers.	E.		
Lagerstroemia indica ...	Pride of India	A large ornamental shrub, with mauve and pink flowering varieties. Handsome and hardy.	E.		
Ligustrum lucidum ...	Chinese privet	An excellent hedge plant or ornamental shrub. Can be clipped into shape. Liable to die off in patches or lose its lower leaves unless planted in moist soil of fair depth. Propagated from cuttings.	A.		

Melia azedarach	Syringa	A deciduous tree, producing a good light timber. Shallow rooting. Withstands drought well. Has fine lilac flowers and persistent yellow berries. Suitable for better rainfall areas and deep sandy soil, but will grow under severe conditions.	E.		
Morus sp.	Mulberry	A very large fruited variety.	E.		
Moschosma	Rhodesian spirea ...	A medium-sized, blue-flowering shrub.	E.		
Nerium oleander	Ceylon rose	The Oleander, Salmon-pink also a white variety.	E.		
Parkinsonia aculeata ...	Jerusalem thorn	A light foliaged tree, up to 20 feet high, with little yellow flowers, very beautiful as isolated specimen on a lawn.	E.		
Persea gratissima	Avocada pear	A shrub with an edible fruit.	2s. 6d. each		
Photinia japonica	Loquat	A small evergreen tree with large leaves, bearing yellow edible fruit.	D. E.		
Phytolacca dioica	Belhambra	A rapid-growing, deciduous tree. Useful for ornament. Timber of no value, but seeds valuable as a poultry or cattle food.	A.	...	pkt. 1s.
Pittosporum undulatum	Camphor laurel	An Australian evergreen shrub, making an excellent hedge, with shining, green, scented leaves and scented berries.	9s. per 100 Class A		
Plumeria rubra	Frangipani	A handsome shrub with pinkish red flowers. Rather delicate.	2s. 6d. each		
Poinciana regia	Flamboyant	A handsome red flowering, feathery foliaged tree.	D.		
Poinsettia pulcherrima	Poinsettia	A shrub with small yellow flowers surrounded by many large, scarlet, leaf-like bracts. Very showy. Double and single varieties.	E.		
Poinsettia albida	Poinsettia	As above, but with yellowish white bracts. Double and single varieties.	E.		
Psidium pomiferum ...	Guava	A small, hardy, evergreen tree, bearing edible, yellow fruit.	D. E.		

Botanical Name.	Common Name.	Remarks.	Price of transplants.	Price of seed. Lb.	Price of seed. Oz.
Punica granatum	Pomegranate	A shrub or small tree, having shining leaves, large scarlet flowers and large red fruit. Makes a useful hedge when well cut regularly.	E.		
Rhus lancea	Karreeboom	A small indigenous tree of graceful appearance, yielding a very durable wood. Useful for ornamental purposes. Forms a fine hedge.	A.	10s.	9d.
Russelia juncea	Coral fuchsia	A pretty red-flowered shrubby plant about 6 feet high.	E.		
Salvia involucra	Salvia	A free-growing shrub with red flowers. Not frost-hardy.	E.		
Spathodea campanulata	African flame tree ...	A handsome, heavy-foliaged tree, bearing bright red flowers. Suited for the heavier rainfall areas on deep soils.	6d. each 18s. per 100		
Streptosolen Jamesonii	Streptosolon	A shrub with orange-coloured flowers in dense masses and pale green foliage. Very frost-tender and delicate.	E.		
Strobilanthes sp.	...	A shrubby herbaceous plant covered with intense blue flowers in the Autumn. 3 feet high.	E.		
Tecoma Smithii	Tecoma	An upright, medium-sized shrub with tubular, bright yellow flowers. Forms a useful hedge. Fairly drought-resistant.	A. E.	...	pkt. 1s.
Thevetia neriifolia	Thevetia	An evergreen shrub, bearing bell-shaped, yellow flowers. Hardy.	E.		
Thuya orientalis	Thuya	A very hardy conifer that withstands heat, cold and drought, and does not mind heavy soils. Slow-growing. Of small size. Very good for hedges.	A. C.	...	pkt. 1s.

Roses from 1s. to 3s. 6d. each.

Climbers and Creepers.

Botanical Name.	Common Name.	Remarks.	Plants each.
Ampelopsis veitchii ...	Virginia creeper	Too well known to need description.	E.
Antigonon leptopus ...	Coral creeper	A showy climber, bright pink flowers, forms large bulbs underground. Takes two or three years to reach flowering size, after this it makes a wonderful display yearly.	E.
Aristolochia elegans ...	Dutchman's pipe ...	A rank-growing creeper. Heart-shaped leaves. Purplish crimson flowers, spotted yellow.	E.
Aristolochia tomentosa	Dutchman's pipe ...	A rapid-growing climber, with crimson purple flowers.	E.
Beaumontia grandiflora	Beaumontia	A large climber with heavy, glossy foliage. Large white, bell-shaped flowers. Blooms profusely. Fairly frost-tender.	1s. 3d.
Bignonia venusta	Golden shower	Vigorous creeper. Rapid-growing. Bears masses of orange flowers all the year round. Very useful and hardy.	1s. 3d.
Bignonia speciosa	Bignonia	A rapid-growing, showy creeper, bearing large mauve flowers. Decumbent.	E.
Bougainvillaea splendens	Bougainvillaea	Vigorous climber. May be also used as a hedge. Bracts magenta. Fairly frost-hardy.	1s. 3d.
Ficus repens	...	A valuable climber for walls, etc., used in places where the Virginia creeper is grown, but clings to the surface much better than the latter, rather slow at first.	E.
Hedera helix	Ivy	A dark evergreen climber. Best in shady, cool climates.	9d.
Jasminum sambac	Jasmine	A vigorous, evergreen shrub climber with large trusses of fragrant, white flowers.	1s. 3d.

Botanical Name.	Common Name.	Remarks.	Plants each.
Jasminum primulinum	Climbing jasmine ...	A yellow-flowering species similar to Jasminum grandiflorum.	9d.
Lantana salviaefolia ...	...	A fine little creeping shrub with pink flowers, very suitable for rockwork, or edging borders, etc.	E.
Lonicera periclymenum	Honeysuckle (Woodbine)	Hardy climber with sweet-scented flowers, yellow inside, reddish purple outside.	9d.
Lonicera sempervirens	Red honeysuckle ...	Climber with red flowers. Best kept well pruned or base becomes ugly.	9d.
Mandevilla suaveolens	Mandevilla	Deciduous climber, bearing trumpet-shaped, white, fragrant flowers. Very slender.	9d.
Passiflora edulis	Granadilla	A quick-growing climber, bearing edible fruits. Subject to woolly aphis if overshaded. A good trellis plant.	E.
Passiflora sp.	Fiji granadilla	A large-leaved climber, bearing yellow fruits. Flowering well. A good trellis plant.	E.
Podranea Brycei	Zimbabwe creeper ...	A rank-growing indigenous creeper with large, pink flowers.	E.
Rosa bracteata	Macartney rose	Plant with large green foliage and numerous white single flowers. Useful as a hedge plant.	1s.
Solanum Wenlandii ...	Blue potato creeper ...	A rapid-growing creeper with tubular, blue flowers. Not frost-hardy.	E.
Wistaria chinensis	...	The well-known climber with lavender coloured panicles of flowers. Purple, and blue kinds also in stock.	E.

Palms, Bamboos, etc.

Arundo donax	Spanish reed	A reed growing 20 feet to 25 feet in height and 1 inch thick, and very superior to the indigenous variety.	Offsets 1s. 6d. each
Bambusa fortunei	Fortune's bamboo ...	A small variety, 6 feet high, with canes about the thickness of a lead pencil, extremely useful for stakes in the garden.	Offsets 2s. 6d. each
Bambusa arundinacea ...	Whipstick bamboo ...	About 30 feet.	Offsets 2s. 6d. each
Bambusa sp.	Japanese striped bamboo	A very ornamental variety with golden rods marked and striped with green lines, about 20 feet.	Offsets 2s. 6d. each
Bambusa sp.	Indian variety	Similar in growth to the Bindura, with very useful rods.	Seedlings 9d. each
Chamaerops excelsa ...	Fan palm	Suitable for shrubberies, etc.	...
Cortaderia argentea ...	Pampas grass	With long white plumes about 6 feet in height, must be grown near water or close to a tap.	Seedlings 9d. each Offsets 2s. 6d. each
Cyperus papyrus	Papyrus grass	A very handsome subject for the water garden, or planted near the drip of a tap, it does best when growing in the water.	3s. 6d. each
Oxytenanthera abyssinica	The Bindura bamboo	The only variety indigenous to Rhodesia, giving very useful solid rods, very tough.	Seedlings 9d. each
Phoenix reclinata	Date palm	A very hardy palm, indigenous to the Colony.	...
Phormium tenax	New Zealand flax ...	A useful green foliaged plant, about 4 feet high with sword-like leaves.	E.
Washingtonia robusta ...	Fan palm	A strong-growing fan palm.	...

Palms 2s. 6d. to 5s. each.

Offsets of Bamboos supplied during January only.

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Jasminum primulinum	Climbing jasmine ...	A yellow-flowering species similar to Jasminum grandiflorum.	9d.
Lantana salviaefolia ...	...	A fine little creeping shrub with pink flowers, very suitable for rockwork, or edging borders, etc.	E.
Lonicera periclymenum	Honeysuckle (Woodbine)	Hardy climber with sweet-scented flowers, yellow inside, reddish purple outside.	9d.
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Passiflora sp.	Fiji granadilla	A large-leaved climber, bearing yellow fruits. Flowering well. A good trellis plant.	E.
Podranea Brycei	Zimbabwe creeper ...	A rank-growing indigenous creeper with large, pink flowers.	E.
Rosa bracteata	Macartney rose	Plant with large green foliage and numerous white single flowers. Useful as a hedge plant.	1s.
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Wistaria chinensis	...	The well-known climber with lavender coloured panicles of flowers. Purple, and blue kinds also in stock.	E.

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Bambusa *fortunei*	Fortune's bamboo ...	A small variety, 6 feet high, with canes about the thickness of a lead pencil, extremely useful for stakes in the garden.	Offsets 2s. 6d. each
Bambusa arundinacea ...	Whipstick bamboo ...	About 30 feet.	Offsets 2s. 6d. each
Bambusa sp.	Japanese striped bamboo	A very ornamental variety with golden rods marked and striped with green lines, about 20 feet.	Offsets 2s. 6d. each
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Chamaerops excelsa ...	Fan palm	Suitable for shrubberies, etc.	...
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Washingtonia robusta ...	Fan palm	A strong-growing fan palm.	...

Palms 2s. 6d. to 5s. each.

Offsets of Bamboos supplied during January only.

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No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

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No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.

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No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.

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No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

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No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

No. 759. Witch Weed (Striga Lutea): Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.

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No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

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No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.

No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

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No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.

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Summary of the Game Laws of Southern Rhodesia

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EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Market for Pedigree Cattle.—The breeders of pedigree cattle have had a thin time since the outbreak of foot and mouth disease, and the reappearance of cattle in the last month at the Salisbury and Bulawayo Shows has served a useful purpose in bringing pure-bred stock to the notice of the public again.

Prices for pure-bred cattle at the Salisbury Show sale were disappointing, but at both the Gwebi sale which followed next day and at the Bulawayo Show sale there was a good demand for pedigree stock. The interest shown in Africander cattle at the Bulawayo sale was a noticeable feature, and the top price for a bull (£54) was paid for one of this breed from the Matopo Estate.

Legislation in the Union foreshadows the compulsory use of improved bulls in certain areas, and if the cattle improvement provisions in the published draft legislation are

enacted, there is likely to be a shortage of pure-bred bulls in the south, which would react greatly in favour of those breeders of pure-bred stock in Rhodesia who have had the courage to "stick to their guns."

In point of fact, there is a great shortage of pure-bred bulls in the Colony. It has been estimated that it would require 3,000 bulls per annum for ten years to improve effectively the quality of the European-owned cattle in the Colony. The present output is possibly 700-800 head, and once regular export trade in cattle and cattle products is developed, the breeder of pedigree stock will be one of the first to benefit.

Insect Transmission of Virus Diseases.—In the last issue of this Journal mention was again made of experiments conducted to demonstrate the possibility of white fly transmitting leaf curl of tobacco. Since that date an interesting article has been received on further studies on plant virus diseases which indicates that, in the case of at least certain kinds of insects which are thus concerned, their ability to transmit virus diseases depends upon the stage of their development at the time when they feed upon infected plants. Kenneth M. Smith reports, in the "Annals of Applied Biology," August, 1932, that when non-infected adults of thrips are colonised upon various plants affected with spotted wilt virus and then transferred to healthy plants the disease is not transmitted. It had previously been shown, however, that when the same species of thrips was applied to virus-infected plants in the larval stage they could, when feeding on healthy plants in the adult stage, then transmit the disease. This interesting phenomenon is exactly the reverse of what happens in the case of the leaf hopper which transmits the virus disease of asters known as Aster Yellows. In this case the adult can transmit the disease, but not the larva. It is possible that the experiments which will be continued next season with leaf curl in tobacco will demonstrate that the stage upon which white fly feeds on infected tobacco has an important bearing on its ability to transmit the disease.

Quality in Wheat.—Although the quantity of wheat produced in this Colony has during recent years only averaged about 20 per cent. of our local requirements, there are definite indications that wheat growing, particularly on wet vleis, is steadily increasing. To meet the millers' requirements for a standard flour of good strength, it has been supposed that it was always necessary to mix a certain proportion of Australian and Canadian wheats with the local produce to secure the desired quality. In order to enable a sufficiently high price to be paid for locally grown wheat, and thus to give encouragement to the industry, the Government has for some years past allowed a rebate of the duty, amounting to about two shillings a bag, on every four bags of imported wheat milled with one bag of locally grown wheat. For a year or two this allowed the millers to pay as much as 27s. 6d. a bag for local wheat, but with the fall in world prices the price fell last year to 23s.

The possibility of continuing any such arrangement is at present under discussion, and the result will be awaited with great interest by all growers. It is highly probable that the price of 23s. per bag will be retained for the coming year for wheat which is not less than 62½ lbs. per bushel. The price is influenced largely by quality, and a number of enquiries have recently been received on this subject which indicate that what is meant by quality in wheat is not generally understood. The same questions are apparently being asked by growers in many parts of the world, and in this issue an article is reprinted from the August number of the *Agricultural Gazette* of New South Wales, which deals with the question in a very interesting manner.

Soya Bean Cultivation.—The British Empire continues to furnish upwards of half the world's requirements in oil-seeds and oils, but Soya beans, olives, hemp seed and sunflower seeds are grown on but an insignificant scale within the Imperial territories. So far as Great Britain is concerned, the imports of olive oil are only small, and hemp seed and sunflower seed are not among the oil-seeds usually crushed in British seed-crushing mills. Soya beans, there-

fore, constitute the only item of considerable importance to the home trade, of which supplies have to be sought from countries outside the Empire. In view of the commercial success which has followed the acclimatisation of the Soya bean in the United States, it is therefore a matter for regret that more has not been achieved with this crop in British territory. The Soya bean ranks second in importance among the world's oil-seeds, and has the additional advantage of being a rotation crop, and it is hoped that more may be done to develop it in the Sudan, South Africa and Australia. It has already been proved as a result of extensive experimental crops that the bean can be grown with success in Northern India and over a large part of South Africa. Experiments in Victoria and Queensland have also been entirely successful. The large scale production of the Soya bean in any of these territories would be a great boon.—*Chemical Age*, July, 1932.

Grain Crops.—"Grain Crops" is the title of the latest publication of the Empire Marketing Board. It is the second of a new series in which the Board is dealing crop by crop with the principal foods of the world and the Empire's share in growing and selling them.

"Grain Crops" deals with wheat, wheat flour, barley, oats, maize, rice and rye. It explains that most of the grain in the world is consumed in the country which grows it, and the proportion of world crops which enters the international market is not large. Only about 16 per cent. of the world's wheat is shipped either as grain or as flour, and the proportions for other grains are even smaller.

The Empire considered as a unit exports more wheat than it imports, contributing nearly three million tons annually to the world markets. Before the war the Empire was on balance an importer of wheat.

Of the other major crop, rice, the Empire is also an exporter to the extent of some 680,000 tons. In other grains the Empire has no such considerable export, and, in fact, is an importer, though not to a large extent, of oats and barley, and imports maize to the extent of two million tons —a third of the crop required.

Prices and their falls in the last three years are illustrated in tabular form.

This book gives in hand compass the relevant figures crop by crop for each of the grains discussed, but it is not a mere compilation of statistics, and the meaning of the figures is explained. It is published by H.M. Stationery Office, and costs 6d.

The World's Dairy Produce.—A number of striking comparisons, showing the importance of dairy produce to the different countries of the world, are given in a new Empire Marketing Board pamphlet "Dairy Produce—A Summary of Figures of Production and Trade" (H.M. Stationery Office, price 6d. nett). It is stated that, taking the world as a whole, milk is a more important contributor than any other single product to the farmer's income, and that eggs probably rank before wheat and rice and immediately after milk.

More milk is used for drinking or cooking than is made into butter, and more is made into butter than into cheese or any other product. Empire countries take second and third places on the list of both butter and cheese exporting countries, but make only a poor showing in the export trade in eggs and preserved milk. In most countries eggs are mainly produced for home consumption, and it is pointed out that only Denmark, among all the exporting countries of the world, exports as much as half its total production of eggs.

Tables are given showing the part played by butter, cheese and eggs in the external trade of the chief exporting countries. Butter represents nearly a third of Denmark's exports, and over a fifth of those of New Zealand. Cheese forms about 13 per cent. of New Zealand's exports. Exports of eggs and egg products take third place in the list of China's exports.

Huge Dairy Imports in Britain.—The United Kingdom is easily the world's largest importer of each of the five products—butter, cheese, preserved milk, eggs and egg

products—dealt with in the pamphlet, and the magnitude of this country's imports from foreign sources makes the Empire, taken as a unit, a nett importer on a considerable scale of each of the five products. The balance of the Empire's import trade amounts to between three and four million cwts. of butter, from 300,000 to 500,000 cwts. of cheese, about three million cwts. of preserved milk, nearly 2,500 million eggs, and approaching a million cwts. of liquid eggs.

This pamphlet is the first of a series which will deal in turn with all the major agricultural products. Grain crops and meat are to be the next group of products in the series.

The World's Meat.—*Division of U.K. Market.*—The unique size and importance of the United Kingdom as a market for meat products, and the small share of the total imports at present enjoyed by the Empire countries, are brought out in the Empire Marketing Board's "Survey of Meat," the latest number in the Board's new statistical series (price 6d.). It gives the figures of world production as far as they can be ascertained, and distribution of exports and imports of all the principal countries, dealing in turn with beef, mutton and lamb, bacon and hams, pork, cattle, sheep, pigs, and canned meat. A particularly useful part of each section is that analysing the position of the Empire considered as a unit importing or exporting from the rest of the world.

The Empire as a Home for Pigs.—The Empire emerges from the enquiry with more than a third of the world's sheep and 40 per cent. of its cattle, but with no more than 4 per cent. of its pigs. Of the 280 million pigs in the world, only 12 per cent. are Empire pigs. The Empire has, however, more than a third of all the goats.

The import of meat into the United Kingdom from the United States, Argentina and Denmark in particular is a large item in our foreign trade. The Empire imports a great deal of chilled beef—400,000 to 500,000 tons annually—and gains of chilled beef at the expense of frozen beef have diminished the share of the Dominions in the United Kingdom

market. Mutton is also imported on a large scale—over 2,000,000 cwts. annually — the United Kingdom being far the most important market in the world for exporters. Foreign imports of lamb have increased and are now 32 per cent. of the total, where they were 23 per cent. in 1926. The New Zealand imports have also increased and are more than half of the total.

Bacon.—The United Kingdom is a heavy importer of bacon, and imports from outside the Empire have been increasing of recent years, averaging well over 400,000 tons annually. Ninety per cent. of the imports of bacon and ham were of foreign origin, about 70 per cent. of the bacon from Denmark and 80 per cent. of the hams from the United States.

Canned Meat.—The United Kingdom is also a very large importer of canned meat, over a million cwts. coming annually—70 per cent. from Argentine and Uruguay and some 8 per cent. from the United States. The Empire countries only send some 4 per cent. of the total imports of canned meat into Great Britain.

Home Production.—The home farmer produces about half of the beef supplies. In the ten years previous to 1928 imports were increasing, but the share of the home producer began to rise, and rose till 1930. The home farmer produces about 43 per cent. of the mutton and lamb. Five million cwts. of pork are produced locally, of which about one-half probably goes for curing. The import figure is more than double this.

PIGGERIES.

(Concluded.)

By B. G. Gundry, A.I.Mech.E.

Before passing on to the colony system of pig keeping, there are two modifications to the building already described which are well worthy of attention.

The first is the introduction of wooden floors in the breeding pens, such floors add considerably to the comfort and health of the sow and young pigs, particularly in cold localities. It also minimises losses at farrowing due to the young pigs getting entangled in deep bedding and being overlain by the sow. As it is essential that the floors should be removable for cleaning purposes, they have to be made in four sections, each section is 2 feet 6 inches wide by 9 feet 6 inches long. If the opening to the pen in made 2 feet 9 inches wide, each section can be slid in under the farrow guard as illustrated on plate 2. It will be noted that where wooden floors are to be installed, the farrow guard must be supported by brackets built into the wall instead of in the floor, and they must also be set 12 inches instead of 9 inches above the concrete floor, so that they are the correct height above the wooden floor when in position.

Lengths of old tyre iron about 4 inches wide and 30 inches long, drilled for a half-inch diameter bolt, 1½ inches from each end will make satisfactory supports. These should be cast in concrete blocks 12 inches long by 9 inches wide by 6½ inches thick, which are built into the wall so that the iron projects by an equal amount on either side of the division walls, and will support the guards in the adjacent pens. The support in the wall between the pen and the yard will need to be only 18½ inches long, as it has to project on the inside only.

The floors themselves are made from ordinary 6 inch flooring supported on four 3 x 2 inch battens to which they are nailed with 4 inch nails, clinched or bent over on the under side.

The second item is a labour-saving device in the form of a special trough set in the front wall of the yard over which hangs a swinging door or shutter. By this arrangement the trough may be filled from the feeding passage without entering the yard, and the pigs are prevented from getting into the trough while the food is being poured in and thus saving waste. At the specified feeding times the doors are swung to the open position to permit the pigs to feed. In some instances where this type of trough is fitted, the gate into the yard is entirely dispensed with, the door of the trough being fully opened to give ingress and exit for the pigs while humans merely stride over the top. This arrangement, although perhaps a little crude, permits one to instal the improved type of trough at very little greater expense.

The illustration on plate 2 shows the method of construction; the pipe from which the door is hung must, of course, be securely fixed at the ends, and this is best done by setting it in concrete blocks, although there are many alternative ways of hanging this door. One cheap method particularly adaptable when the ordinary gates are dispensed with, is to lay a stout piece of timber such as a gum pole 4 or 5 inches in diameter on the top of the wall to which it must be secured with hoop iron straps, and hinge the door with rings to eye bolts passing through this timber. A more permanent method is to cast a reinforced concrete lintel over the opening and set the eye bolts into that.

The door is kept open or closed by means of two 12 inch tower bolts which engage with lengths of small diameter iron pipe set in the front and back edges of the concrete trough.

Colony Houses.—In countries where building timber is relatively cheap, pigs are frequently housed in wooden sheds built on runners so that they can be hauled from camp to camp, but such buildings would be too costly in this Colony, and as an alternative it is recommended that a type

of temporary house such as that illustrated on plate 2 should be used.

Such a house consists of four upright poles carrying a roof of corrugated iron covered with thatch, or of thatch alone. The sides may be of single sheets of corrugated iron or of pig-netting or wooden rails covered with thatching grass, tied on with "tambo" or baling wire.

If the roof is made as a separate unit and bolted to the uprights, it can be readily transported to a new set of uprights on a new site each season, or if the butts of the uprights are tarred they can be dug up and transferred from one site to another, and such houses in which iron is used may be regarded, at least, as semi-portable; those of thatch only would be better burnt when finished with.

Automatic Feeder.—Various types of automatic feeding hoppers are popular among pig farmers in America where they are strongly advocated by the various agricultural authorities.

Many advantages are claimed for this method of feeding. In the first place it saves labour, as several days' supply of food can be placed in the hopper of a feeder and is available as and when required. An economy in food is effected, as it cannot be easily scattered. The pigs being "food wise" select the food they require and to a large extent balance their rations, with the result that the pigs put on weight quicker than when fed by hand for a smaller consumption of food per pound of increase in weight.

This method of feeding is particularly advantageous for young pigs and porkers which require food in small quantities at frequent intervals; it is, however, likely to be overfattening for baconers. There is no danger of pigs overeating themselves.

There are many designs of these feeders, and one of the simpler type is illustrated on plate 2. As will be seen, it consists of a hopper 5 feet long and 2 feet wide, divided into two compartments 1 foot and 4 feet long respectively; the former is for meat and blood meal, etc., and the latter for maize or other grain.

The flow of feed from the bottom of the hoppers into the troughs on either side is controlled by adjustable hinged

flaps by which the opening through which the food escapes may be varied in width to suit the particular type of food.

As will be seen in the drawing, the flaps themselves, which are 9 inches wide and run the full length of the compartments, are hung by 4 inch strap hinges to 6 inch boards, the position of which is adjustable by means of round headed bolts fitted with washers and wing nuts passing through vertical slots in the lowest fixed boards in the sides of the hopper. The position and length of the slots should be such that the opening between the bottom of the flaps and the trough through which the food passes, may be entirely closed or opened to a width of 2 inches.

The correct adjustment of the openings is all-important if the full benefit of this type of feeder is to be obtained. The flaps should be set so that the action of the pigs nosing at the opening and pushing against the flaps will cause the food to trickle through at the proper speed. The pigs should have to work for their feed, but must not be discouraged by too great a difficulty in obtaining it. The object of having the flaps hinged is to permit them to move inwards and thus agitate the food and prevent it sticking in the opening.

Hay Rack.—A hay rack constructed of native timber as is shown in plate 2 is useful, where breeding pigs are kept in paddocks or pens, for feeding lucerne and other palatable leguminous hay. By the use of such racks the hay is kept dry and clean and the pigs are encouraged to eat such hay, with, as a rule, beneficial results on the size of the litters. The main frame work is best bolted together with three-eighth inch diameter bolts, and the thinner sticks forming the sides can be either nailed in place or bound on with fencing wire.

Troughs.—Two types of portable troughs are illustrated. The first is of concrete and may be constructed in the following manner:—A log of wood about 6 feet long and 12 inches in diameter, as straight and circular as possible, is embedded in a piece of level ground up to its longitudinal axis. The ends are bevelled off to a good slope so that it will eventually draw away from the concrete cast round it without difficulty. Two strips of board 2 inches wide and 1 inch thick are now laid on the ground on either side of the log

and are trimmed up where necessary so that the inner edges fit neatly against the log along its whole length. The strips should extend 3 inches beyond each end of the log, and the spaces between the projecting ends are filled in with other pieces of board. Two lengths of 9 inch by 1½ inch plank, planed smooth on the inner side, the same length as the strips, are now placed upright on either side and are held in position by three pegs about 2 inches square, driven well into the ground. If the soil is not sufficiently hard to hold them rigid, strips of wood (not shown in the drawing) may be nailed across each pair of pegs to tie them together and prevent them being forced apart when the concrete is rammed into the mould. In any case these ties would be an advantage, as it is desirable that the mould should be as rigid as possible. Two end pieces of 9 inch by 1½ inch plank are now screwed to the end uprights, to which the side planks should also have been nailed or screwed and the mould is complete.

Any cracks in the log or planks and any crevices between them should be filled in with clay or wax, and the whole interior surface with which the concrete will come in contact should be rubbed over with thick oil or grease to prevent the concrete sticking, but it must not be left as a thick layer which will mix with, and spoil the concrete.

Actually, all that is now necessary is to fill the mould with concrete, but the writer would suggest that before doing so the inside of the mould should be roughly plastered over with a thin layer of 1:2 cement plaster in order to give the inside of the finished trough a hard smooth surface.

This must be done as the concrete is being mixed, as the plaster must not be allowed to commence to set before the concrete is added. The whole operation of plastering and filling should be completed within half an hour from the time water is first added to the plaster and concrete. The concrete should be mixed in the proportion of one part cement, two-and-a-half parts sand and four parts stone, which must be crushed to pass a ¾ inch ring. About half a bag of cement will be required for the job.

When filled, the mould must be covered with wet sacks and kept continuously damp for at least 72 hours before any attempt is made to remove the trough from the mould.

After removal the trough must be immediately re-covered and kept damp continuously for a further four or five days—longer if possible.

A mould of this description can, with reasonable care, be used over and over again, but the timber should not be left exposed to the sun as it will warp and twist; in fact it is a great advantage to carry out any concrete work of this nature in an entirely shaded spot.

A light wooden trough can be fairly easily constructed from 9 inch by 1½ inch planks. Two end pieces are cut to the shape shown in the illustration, which are designed to prevent the trough being readily overturned. The sides of the trough are let into the end pieces to a depth of half an inch. This can be done by making two pairs of saw cuts 1⅜ inches apart and half an inch deep, roughly at right angles to each other and cutting out the intervening timber with a chisel, thus forming two grooves into which the ends of the side planks are fitted. Three screws 4 inches long can then be driven in through the end piece into each side piece. If a strip of stout hoop iron is nailed right round the edge of each end piece and other strips are used to tie the sides to the end pieces, the durability of the trough will be considerably increased.

Such a trough can be made to any convenient length up to 6 or 7 feet. A plank 16 feet long, costing about 8s., will make a 6 foot trough.

Pig Creep.—This is merely a grating made of straight veld poles nailed or screwed together, which can be placed across the corner of a pen, and behind which small troughs may be placed to which the young pigs will have access but from which the sow will be excluded. This is a big advantage in forcing the growth of the young pigs, and when necessary special rations can be fed to them only. The creep can be held in position by screw hooks engaging with eyes screwed into wooden plugs driven into the walls of the pen.

Rubbing Post, or Self Oiler.—The oiling of pigs as a remedy for lice is a messy operation which can, to a large extent, be avoided by the use of this device. It consists of a wooden post driven securely into the ground and round

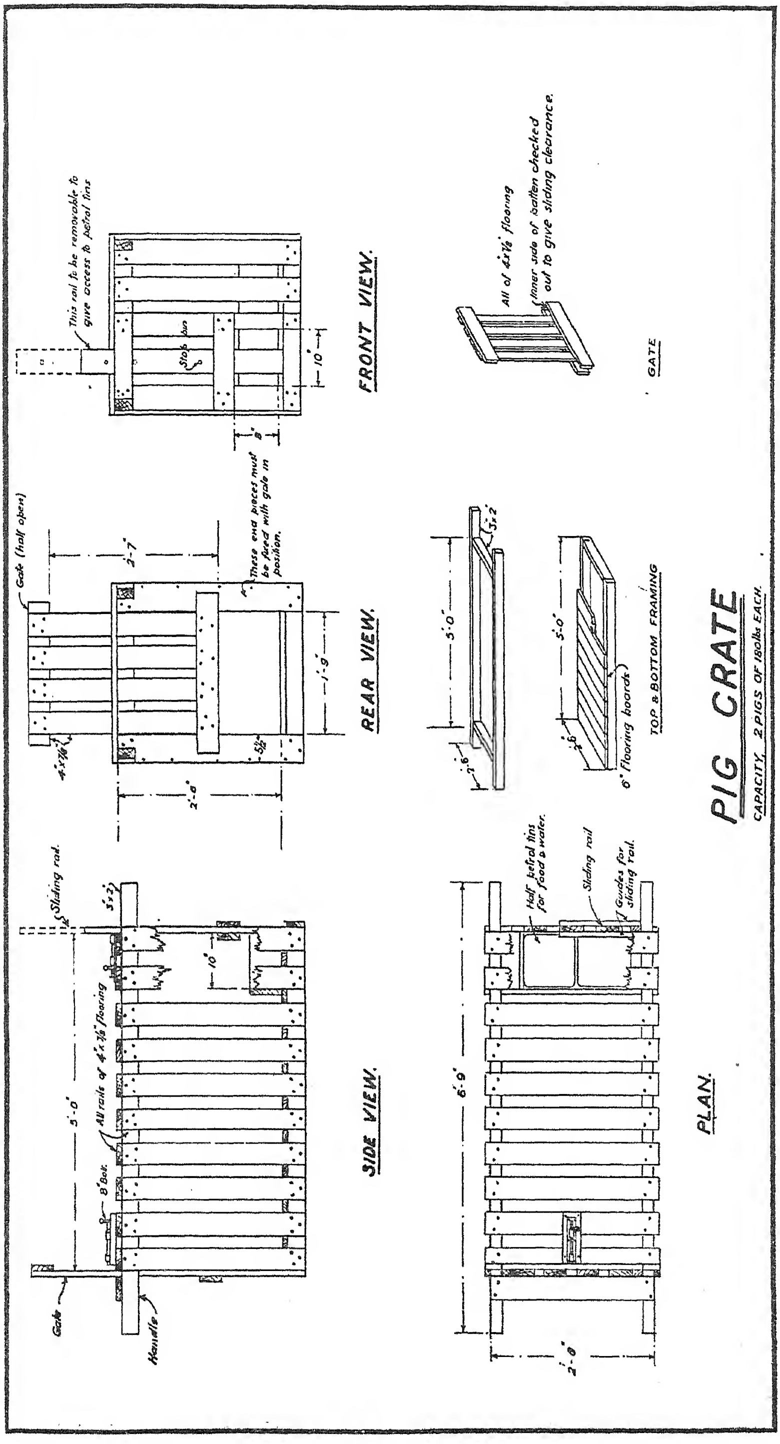
which an old sack is tied. The sack is kept saturated with oil (practically any variety, such as old sump oil, will do). By rubbing themselves against it the pigs keep themselves oiled, but frequent applications of oil to the sack are necessary to render it fully effective when lice are troublesome.

Shipping Crate.—Figure 3 shows a shipping crate designed to meet the requirements of a farmer who was sending pigs to market by the railway road motor service. The journey occupied two days, and it was necessary to provide means by which the animals could be fed and watered *en route* without allowing them out of the crate. For shorter journeys the feeding arrangement is unnecessary. This particular crate was designed to carry two animals weighing 180 lbs. each, but the following table of sizes published by the University of Missouri may be found useful in arriving at the dimensions of crates for individual requirements:—

Weight of hog (lbs.)	Length of crate (inches)	Width of crate (inches)	Height of crate (inches)
25 to 75	35	12	23
75 to 150	46	18	28
150 to 250	54	20	34
250 to 350	60	20	38
350 to 500	64	24	40
500 to 800	80	30	48
800 to 1,000	84	30	50

It is suggested that a crate to carry two animals should be made somewhat wider and shorter than the dimensions given for a single animal of equivalent weight.

Unless some suitable timber is available, such as a motor car packing case, ordinary 4 inch and 6 inch flooring can be used, the tongues and grooves being first removed, as the former will splinter and the latter collect dirt and vermin. The gate and sliding rail which gives access to the feed and water tins are each kept closed by ordinary tower bolts, or special locking bolts which can be secured with a padlock may be used if desired. The whole crate should be assembled with wood screws, as nails will soon work loose. The cost of materials for the crate illustrated would be approximately 30s.



PIG CRATE
CAPACITY, 2 PIGS OF 180lbs EACH.
SIDE VIEW.
REAR VIEW.
FRONT VIEW.
PLAN.
TOP & BOTTOM FRAMING
GATE
Sliding rail.
5"x2"
All rails of 4"x 7/8" flooring
8" Bolt.
Gate
Handle
5'-0"
10"
6'-9"
2'-6"
Half petrol tins for food & water.
Sliding rail
Guides for sliding rail.
Gate (half open)
2'-7"
These end pieces must be fixed with gate in position.
4"x7/8"
2'-6"
1'-9"
5½"
This rail to be removable to give access to petrol tins
Stob pin
10"
8"
5'-0"
2'-6"
5"x2"
6" Flooring boards
All of 4"x7/8" flooring
Inner side of batten checked out to give sliding clearance.

Figure 3.

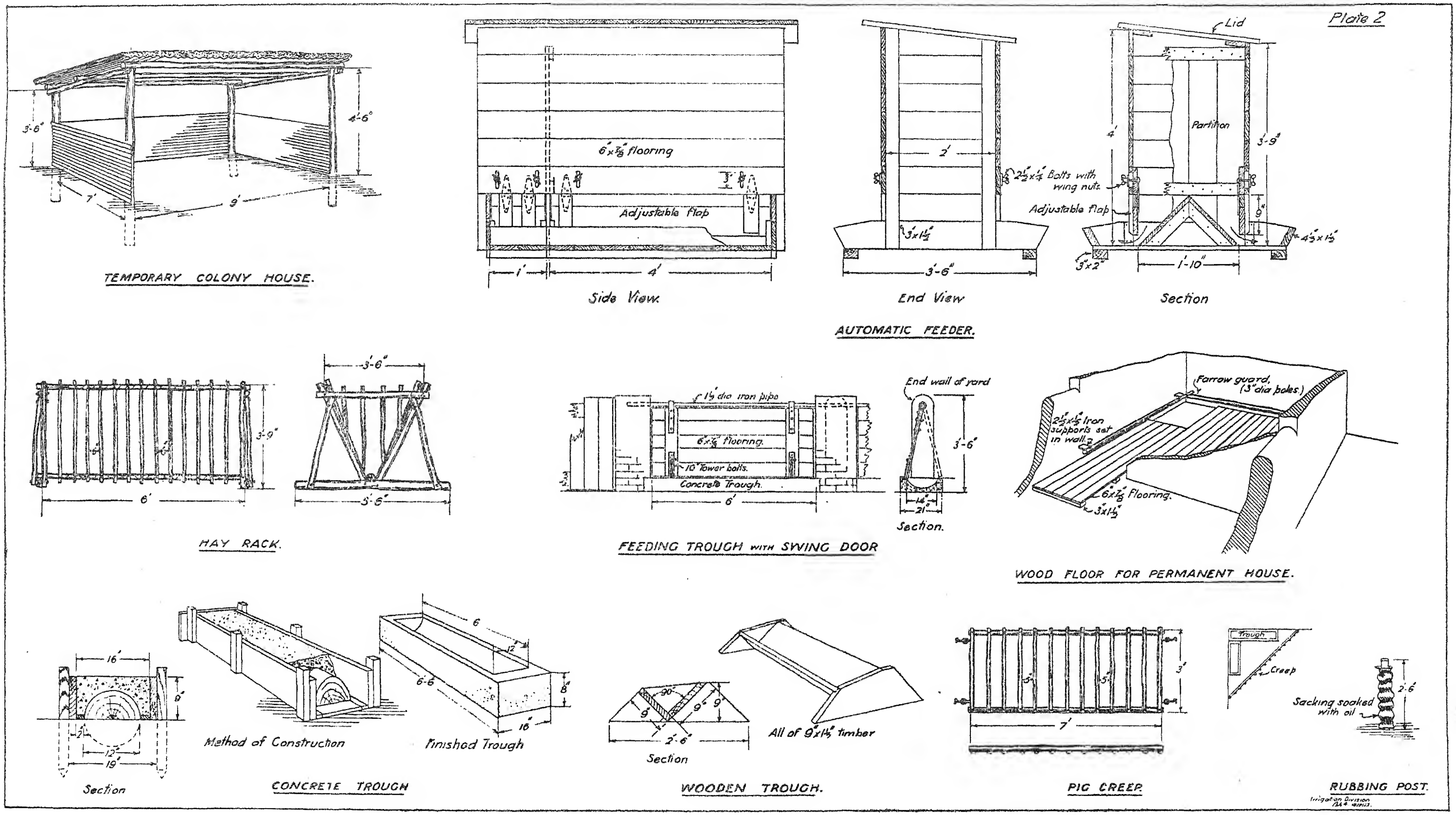


Plate 2
TEMPORARY COLONY HOUSE.
3'-6"
4'-6"
7'
9'
6"x7/8" flooring
Adjustable flap
Side View.
1'
4'
2'
2½"x¼" Bolts with wing nuts.
3"x1½"
3'-6"
End View
Lid
Partition
4'
3'-9"
Adjustable flap
9"
4½"x1½"
3"x2"
1'-10"
Section
AUTOMATIC FEEDER.
3'-6"
3'-9"
6'
HAY RACK.
1½" dia iron pipe
6"x7/8" flooring.
10" Tower bolts.
Concrete Trough.
6'
End wall of yard
3'-6"
14"
21"
Section.
FEEDING TROUGH WITH SWING DOOR
Farrow guard, (3" dia poles.)
2½"x½" Iron supports set in wall.
6"x7/8" Flooring.
3"x1½"
WOOD FLOOR FOR PERMANENT HOUSE.
16"
9"
12"
19"
Section
Method of Construction
6
12
6-6
8"
16"
Finished Trough
CONCRETE TROUGH
90°
9"
2'-6"
Section
All of 9"x1½" timber
WOODEN TROUGH.
3'
7'
PIG CREEP.
Trough
Creep
Sacking soaked with oil
2'-6"
RUBBING POST.

Concrete and Cement Work.—As cement figures rather largely in the building of a permanent piggery, some of the more important points to be observed in its use for making concrete and cement plaster are given here, but for more detailed instructions the reader is referred to an article entitled "Concrete on the Farm," by N. P. Sellick, which was published in this Journal in April, 1926, and which is available as Bulletin No. 588.

Cement deteriorates rapidly in storage, and only fresh stocks should be used for permanent work. All sand used for concrete or cement plaster should be clean, sharp river sand which should not contain a large proportion of dust or fine particles. Sand containing dust or clay can be made useable by washing, but for any but small quantities this is rather a laborious business. Any hard, clean stone, such as granite quartz diorite or quartzite may be used as an aggregate, but friable or oxidised stone is useless. The stone should be crushed so that no pieces are larger than that required for the particular job.

The water used for mixing cement should be clean and reasonably free from dissolved impurities.

The ingredients of concrete or cement mortar should be accurately measured to give the proportion required, by the use of paraffin tins, or for large quantities, proper measuring boxes. These consist of four sides, but have no top or bottom, and should be so proportioned that they contain some even number of cubic feet.

As the inclusion of earth or clay seriously affects the strength of cement mixtures, the mixing must not be done on the bare ground, but on a proper platform of wood or iron or on an existing cement floor.

The cement and sand should be thoroughly mixed, first while quite dry, after which the stone, which may with advantage have been previously wetted, is added. The whole should again be thoroughly mixed, being turned completely over at least twice before the water is added, which is best done by means of a watering can fitted with a rose.

As soon as the water is added the concrete or mortar must be mixed thoroughly and as quickly as possible. Only sufficient water should be added to reduce the mass to a workable consistency, as any excess of water tends to wash away the cement and also reduces the ultimate strength of the concrete. It will be found that in the final stages of the operation the mixing alone will reduce the mass to a more liquid consistency without the addition of more water.

All cement mixtures, whether concrete, mortar or plaster, should be placed and finished off within 30 minutes from the time the water is first added.

Cement work, after being finished, must be "cured" by being kept damp for as long as possible; a concrete floor should be covered over with wet sacks or clean grass and kept continually wet for at least seven days; if circumstances permit this period may be doubled or trebled with advantage.

In the case of concrete plastered walls of a piggery, the same course should be adopted as far as possible, although it is not so easily done, but even if continued for a day or two, the ultimate hardness of the plaster will be very considerably increased.

Quantities.—For estimating purposes, a list of the more important materials required for the construction of a unit of six complete pens and yards only, similar to those shown in plate 1, and their approximate cost is given herewith:—

Quantities for Six Pens and Yards.

Item.	Quantity.	Approximate Cost f.o.r. Salisbury.
Bricks	18,500	—
Lime	19 bags	£4 8 8
Damp course, 26 g. gal. iron	15 sheets	2 12 6
Alternative damp course, 3-ply felt	25 yards	2 0 0
Cement for concrete floors ...	45 bags	26 0 0
Alternative cement for grouting masonry floors	6 bags	3 9 0
Cement for plastering walls ...	20 bags	11 10 0
Timber for roofing, 6in. x 2in. x 16ft.	6 lengths	4 5 0
Timber for roofing, 6in. x 2in. x 18ft.	6 lengths	
Roof iron, 24 gauge, 12ft. long	36 sheets	12 5 0
Roofing screws and washers	2½ gross	0 8 3
Timber for gates, 6in. x ⅞in. x 14ft. flooring	9 lengths	1 5 0
Timber for gate posts 3in. x 1½in. x 14ft.	3 lengths	0 7 0
Tee hinges, 18in.	12	1 7 0
Bolts for securing gate posts, 24in. x ½in.	6	0 9 0
Bolts for securing gate posts, 9in. x ½in.	12	0 3 0

A PARASITE ON COWPEAS.

(*ALECTRA VOGELII* BENTH.)

By J. M. Rattray, M.Sc., Botanist.

Introduction.—The root parasite *Alectra Vogelii* Benth, has just recently caused a certain amount of damage to cowpea crops in Southern Rhodesia, and unless due precautions are taken there is a likelihood of the pest increasing and causing considerably more trouble.

Growers of cowpeas, French beans or groundnuts would be well advised periodically to inspect their crops thoroughly to ascertain whether this pest is present, and to eradicate immediately any plants which appear to be similar to the one here described.

This plant, which belongs to the same family as the ordinary garden snap-dragon and the common parasite on maize, witch-weed, is parasitic on the roots of cowpeas. As far as our own observations go, it appears to confine itself to this particular leguminous crop as a host, but in the Union of South Africa it has been found on French beans (*Phaseolus vulgaris*) and monkey nuts (*Arachis hypogea*) as well.

The original specimen of the parasite which was sent in for identification was named *Melasma orobanchoides*, but there still appears to be a certain amount of controversy among botanists with regard to the two genera *Alectra* and *Melasma* and the parasitic habits of each. Several species of *Alectra* were formerly included under *Melasma*, but more recent authorities consider that all the parasitic forms should be included under *Alectra*. *Alectra Vogelii* Benth is the commonest parasitic species found in this country.

Description.—In appearance the plant is an erect, hairy herb, 9 to 19 inches high, sometimes branched at the base. The branches are straight and bear flowers and leaves almost

from the base upwards. The leaves are small, about an inch long and half an inch wide, and have three main veins which can plainly be seen when the leaf is held to the light. The flowers are yellow in colour and about half an inch in diameter, and grow out on short stalks of not more than a quarter of an inch in length, from the junction of the leaves and the main stem.

The base of the stem, just below the surface of the soil, is a bright orange-yellow colour when freshly pulled out, and where the underground portion of the parasite comes in contact with the cowpea roots, it is swollen and matted with fine roots. Characters which make the plant easily recognisable are:—

1. The three main veins in the leaf.
2. The yellow colour of the flowers.
3. The bright orange colour of the base of the stem when first pulled out of the ground.
4. The swollen underground portion which is in contact with the host-root.

Control.—Owing to the very free seeding habit of this plant and the extraordinary length of time for which the seeds remain viable, and lie dormant in the soil, it would appear to be a most difficult pest to eradicate. It is an established fact that even after allowing six years to elapse before planting cowpeas again on infected land, the legume was attacked by the parasite.

Probably the surest way of controlling the pest, therefore, would be to prevent it from seeding by hoeing out every plant while it is still in flower. If cowpeas are again sown on the land it is more than likely that the parasite will appear again, but continued hoeing ought eventually to eliminate it, as all old seed which had been lying dormant in the soil will have germinated, and no fresh seed will have been allowed to fall.

Another method of control which might successfully be employed is that of planting a catch crop of cowpeas and ploughing it in for green manure before the parasite sets seed. Here, of course, it would be absolutely necessary to do the ploughing before any seed had been formed by the Alectra plant.

Fig. 1.—Above-ground portion of *Alectra Vogelii*, showing flowers and leaves.

Fig. 2.—Flower of *Alectra Vogelii*.

Fig. 3.—Underground portion of *Alectra Vogelii*, showing the swollen root attached to a cowpea root.

Conclusion.—The source of this pest is obscure at the moment. The cowpea (*Vigna sinensis* = *V. catjang*) is described as being a widely spread plant, especially in the tropics, so that if it occurs in the wild state in Africa, the supposition is that it is probably attacked by *Alectra Vogelii* in its natural surroundings. Again, since it has been found that the French bean and the groundnut have been attacked by the parasite, it is quite possible there are other legumes which may be hosts.

The parasite may therefore have been introduced into cultivated lands through there being other native leguminous hosts, or through it being parasitic on the wild form of cowpea. Unfortunately it has not yet been reported on any native legume either in Rhodesia or the Union, so that the above theories as to its source are still merely theories.

Once the parasite has made an appearance on cultivated crops, it can very easily be disseminated throughout the country owing to its free-seeding habit. Farming implements are likely agents of transportation, and could carry the seeds from one land to another, where they would remain dormant in the soil awaiting favourable opportunities for germination.

If farmers would report, therefore, the occurrence of any plants resembling this parasite which appear to be attacking either wild or cultivated leguminous plants, much might be done to arrive at a definite means for its control and eradication.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

ANNUAL REPORT, 1930-31 (Concluded).

By H. C. Arnold, Station Manager.

Published with the authority of the Chief, Division of Plant Industry.

LIMING EXPERIMENTS.

First Series.—These trials were commenced six years ago, when in 1925-26 duplicate plots of land were dressed with half ton and one ton of lime respectively. Two controls which received no lime were included. The plots have been cross-planted in strips each year to maize, cotton, ground nuts, sunflowers and haricot beans. Owing to the lack of uniformity in the inherent fertility of these plots which became apparent in 1926-27, it was deemed advisable to divide them, and having ascertained the crop-producing power of each of the halves, to make further applications of lime before continuing the trials the following season. Hence on one half of the plots, which had previously been treated at the rate of one ton of lime per acre, a further dressing was given; on one half of each of the original half-ton plots an additional half-ton was applied, and on one half of each of the plots which had not previously been limed, a dressing of three tons per acre was applied.

In the series, therefore, we have had duplicate plots which have received lime at the following rates in tons per acre: 0; ½; ½ plus ½; 1; 1 plus 1; 3. In the tabulation below are shown the average yields of duplicate plots for the season before the second applications were made, as

well as those for the subsequent seasons. The columns are arranged in the same order as the plots occur in the field.

Yields of Maize in Bags per Acre.

Treatment, August, 1925.	One ton of lime.		Half ton of lime.		No lime.	
Yields, 1926-27	17.10	17.40	19.95	18.75	13.20	13.05
Second treatment August, 1927, on one half of each of the original plots ...		one ton lime		half ton lime		three tons lime
Yields, 1927-28	16.65	17.40	18.00	17.25	16.60	17.55
Yields, 1928-29	12.45	12.56	15.37	14.92	11.29	14.47
Yields, 1929-30	12.32	13.78	13.33	12.96	11.68	14.51
Yields, 1930-31	14.55	14.70	14.10	13.95	12.15	14.63
Totals 4 seasons	55.97	58.44	60.80	59.08	47.72	61.16
Difference due to second treatment	2.47		1.72		13.44	
Average annual difference	.62		.43		3.36	

Examination of the yields during the season 1926-27 shown in the central pair of columns shows that the soil to which the second application of a half-ton of lime was made was less fertile than that of the plots which received no additional lime, the difference in yield being 1.20 bags per acre. The application of half a ton of lime appears to have increased the yield of the treated plots so that after the dressing was applied the four-year average was only half a bag less than that of the treated plots, which indicates that this small dressing of lime increased the yield of those plots by approximately .77 bags per acre per annum. From the returns shown in the left hand pair of columns, it is seen that although the yields of the two halves of the plot which received the one ton dressing in 1925 were about equal in the season 1926-27, those on the half which received an additional ton of lime were increased by .62 bags per acre per annum. There is also a marked difference in favour of liming where the heavy dressing of three tons was applied to land which had not previously been treated.

Second Series of Liming Experiments.—In 1928 two strips of land which were carrying maize were each divided lengthwise, and each of the four strips thus obtained were divided crosswise into six sub-plots, and the yield of

each of the twenty-four sub-plots was recorded. Later, the two central strips of sub-plots were dressed with agricultural lime at the rate of one ton per acre, and the two adjoining strips were left untreated. The land was then ploughed in the usual way. In this experiment, therefore, each of the sub-plots which has received lime has a neighbouring sub-plot which has not been treated, and each pair of sub-plots has received exactly the same treatment in all other respects over a period of several years.

The table below shows the four groups of sub-plots and the yield of each during the season 1927-28 (before the trials began), and in the next column are shown the combined yields of the two seasons 1928-30 (following the application of lime to two groups). The whole area received farm manure in 1926-27 at the rate of 6 tons per acre.

Yields of Maize in Bags per Acre.

	1927-8. Before trials began.	1929-31. No lime.	1927-28. Before trials began.	1929-31. One ton lime per acre.	1927-28. Before trials began.	1929-31. One ton lime per acre.	1927-28. Before trials began.	1929-31. No lime.
	18.48	29.58	17.64	31.98	15.24	28.65	16.68	25.98
	20.52	23.55	19.20	24.87	13.32	21.93	12.48	17.64
	20.64	32.88	19.68	37.32	14.28	27.72	14.16	21.18
	19.56	27.66	18.24	33.84	15.36	26.22	16.08	20.68
	20.16	18.54	18.84	26.82	13.32	31.56	14.04	31.80
	18.24	22.26	19.32	33.30	16.44	32.28	18.00	28.44
Totals	117.60	154.47	112.92	188.13	87.96	168.36	91.44	145,72
Averages ...	19.60	25.75	18.82	31.36	14.66	28.06	15.24	24,29
Difference between average yield 1927-28 and 1929-31	plus 6.15		plus 12.54		plus 13.40		plus 9.05	

By comparing the yields quoted in the left of each pair of columns, the degree of fertility of the various sub-plots before this experiment began can be gauged. They indicate that the average fertility of the sub-plots which were subsequently limed was at that time slightly lower than those which received no treatment. Since the application of lime, however, the sub-plots which received the dressing have, in every case, given heavier yields than

their counterparts which were not treated. These results indicate an average increased yield of 5.37 bags per acre during the three-year period 1929-31 as a result of applying one ton of lime per acre.

In the third series of trials, on a block of sixteen plots arranged after the manner of squares on a chess-board, alternate plots were dressed with lime, four receiving half a ton, and another four one ton of lime per acre. In the season 1928-29 maize was grown, in 1929-30 hay crops, and during the season under review, after dressing the whole with 200 lbs. per acre of phosphatic fertiliser, maize was again sown on this area. The tabulation below shows the average yields of the plots under different treatments, before and after the application of lime in August, 1928.

Maize Yields in Bags and Hay in Tons per Acre.

Maize, 1927-28 (before liming).	Treatment, August, 1928.	Maize, 1928-29, average of all plots.	Legume hay, 1929-30.	Maize, 1930-31, average of all plots.
8.48	1 ton lime (4 plots)	8.37	3.01	12.84
8.56	½ ton lime (4 plots)	7.70	2.54	11.76
8.27	No lime (8 plots)	6.77	2.49	10.8

All three series of experiments recorded above point to the fact that applications of lime to soils of the type met with on this station are of material benefit in increasing crop production, but it still remains a moot point as to whether a similar expenditure on artificial fertilisers or fertilisers combined with green manuring might not afford an even more favourable financial return. Enquiry into this aspect of the case is in progress.

The Effect of Nitrate of Soda on the Yield of Maize.—It is well known that in common with other grain crops, maize requires large amounts of nitrogen for its development, and the object of these experiments was to determine whether applications of nitrate of soda could be beneficially employed in the production of this grain crop.

In the season 1929-30, after a basal dressing of 400 lbs. per acre of potassic superphosphate had been given over the whole area, nitrate of soda was applied in three different ways, namely :—

(a) 75 lbs. per acre in the drills when the seed was sown.

(b) 150 lbs. per acre in the drills when the seed was sown.

(c) 75 lbs. per acre broadcast when the young plants were between six and twelve inches high.

(d) Control (no nitrate).

Each of the nitrate dressings was applied on quadruplicate plots, and the results are shown in the following tabulation :—

Yields of Maize in Bags per Acre.

	A. 75 lbs. with seed.	B. 150 lbs. with seed.	C. 75 lbs. on growing crop.	D. No nitrate.
	10.80	12.88	13.60	13.12
	13.04	13.04	12.80	13.76
	13.84	13.76	14.40	13.20
	15.44	11.60	12.24	13.36
Averages	13.28	12.82	13.26	13.36

These results failing to show any beneficial effect from the treatment, the method of applying the nitrate of soda was changed as follows during the season under review :—

(a) 100 lbs. per acre when the plants were 12 to 24 inches high.

(b) 100 lbs. per acre when the plants were nearing the flowering stage.

(c) 100 lbs. per acre in weekly applications of 25 lbs. each, commencing when the plants were 12 inches high.

(d) Control (no nitrate).

The whole area was previously dressed with 400 lbs. per acre of potassic superphosphate, and the relative nitrate dressings were applied on triplicate plots. The results obtained from the various treatments were as follows :—

Yields of Maize in Bags per Acre.

Stage of growth of plants when nitrate applied.	12in. to 24in. high.	Near to flowering.	After 12in. high at weekly intervals.	No nitrate.
	20.88	21.60	17.76	19.20
	19.92	20.88	21.84	19.68
	15.60	17.00	20.21	15.36
Averages	18.80	19.82	19.93	18.08

Although the average yields from the plots which received nitrate of soda were somewhat larger than those of the untreated plots, statistical analysis of these results shows that this evidence of increase due to treatment cannot be accepted without reserve. Further, as the increase at best was less than two bags per acre and the cost of the fertiliser was 16s., the nitrate in this form for the maize crop would not be profitable under normal conditions. It may be said, therefore, that no matter whether the nitrate of soda was applied in bulk at seeding time, or as a top-dressing during the growth of the plants, and even in the form of small and frequent applications during the growing period, it has failed to give an economic return.

The Relative Value of Sunn Hemp and Sunflower for Green Manure.—For a number of reasons Sunn hemp has become the most popular leguminous crop for use as a green manure in this Colony, but during recent years the scarcity and high cost of its seed has curtailed its use, and a number of farmers have been obliged to employ other crops instead. Of these the sunflower appears to possess considerable merit. Trials were commenced in 1928-29 to test the relative value of the two crops when used as green manure for the maize crop. Duplicate plots were sown to Sunn hemp and sunflower, and plots on which equal weights of seed of both crops were sown together were included. All plots were sown at the rate of 48 lbs. of seed per acre, and a dense stand resulted. Two crops of maize have been reaped since the green crops were ploughed under, and the mean annual yields of the two crops in bags per acre were as follows:—Sunn hemp and sunflower mixed, 13.74; sunflower only, 13.54; Sunn hemp only, 13.36. The difference between the yields is so small in comparison with that between plots treated alike that they must be ascribed

entirely to chance, but it is interesting to note that the sunflowers have given results equally as beneficial as those of the Sunn hemp, in spite of the nitrogen gathering powers of the legume.

These trials are being repeated in a new series in which the various treatments are replicated nine times, and meanwhile it must be borne in mind the density of the stands of sunflower obtained on this station is usually much heavier than that obtained by farmers who employ sunflowers as a green manure crop.

Ground Nut Fertiliser Trials.—The cultivation of this crop having increased somewhat during the past decade, the question has arisen as to whether farm manure or fertiliser can be profitably employed to increase the yields of nuts.

The results of experiments with farm manure are recorded in the annual report for this station for the season 1926-27. Owing to the small increases obtained, it was concluded that the limited amount of this manure usually available could more profitably be used on other crops, and in consequence experiments with artificial fertilisers were commenced in the season 1927-28. The results of the first and second series were fully reported on last season.

Third Series.—At the request of the Enterprise Farmers' Association, basic slag was included in this series of experiments, but, as the results of previous experiments indicated that nitrogenous fertiliser had no beneficial effect, the treatments were rearranged as follows:—

(1) Basic slag, 200 lbs. per acre.

(2) Superphosphate (19 per cent., P_2O_5), 200 lbs. per acre.

(3) Superphosphate, 200 lbs., plus muriate of potash, 50 lbs. per acre.

(4) No fertiliser.

Each treatment was given to four plots, each 1/32 acre in extent, arranged in the form of a Latin square, and the yields of each of the plots are shown below for season 1929-30 in the first column and season 1930-31 in the second column.

Yields in lbs. per Plot of 1/32 Acre.

	(1)		(2)		(3)		(4)	
	63	34	38	29	52	27	47.5	28
	64	32	62	35	70.5	36	37.5	24
	62.5	35	62	31	53.5	34	63.5	28
	55	34	71	34	53	35	61	27
Total yields for four plots ...	244.5	135	233	129	229	132	209.5	107
Total yields over two years ...	379.5		362		361		316.5	

Although the yields are considerably lower this season than last, there is much less variation among the yields of the plots which have been treated with the same dressing, and there is definite increase due to the phosphatic fertilisers, though no response to potassic fertiliser is indicated. Over two seasons the average increase from the fertilised plots equalled 408 lbs. per acre. If the value of this was 1d. per lb. it would amount to 34s. and would yield an appreciable profit on the outlay for phosphate. But the increased value of the crop is not fully revealed by the increased weight, because the fertilised crop produced a greater portion of large nuts, whose value is enhanced by their suitability for the confectionery trade.

Since the increase due to fertiliser was proportionately greater in the second season after its application, the experiment confirms those previously reported, in showing that while phosphatic fertiliser may be profitably used on soils of somewhat low fertility, there is little response to fertiliser treatment on land which has been maintained in a moderately high state of fertility, and that ground nuts do not respond to phosphate treatment to nearly the same extent as maize and several other crops. It is therefore considered that under normal conditions of soil fertility it will be found more profitable to follow with ground nuts after some other fertilised crop rather than to apply fertilisers direct to the nuts.

Ground Nut Variety Trials.—A previous series of trials showed that the varieties which yielded the heaviest crops under local conditions were Spanish Bunch, Virginia Bunch

and Jumbo, and these are now accepted as standard varieties for comparison with new strains which may be received from time to time. Two new sorts were included in our trials this season, one was derived from Spanish Bunch by selecting pods containing five kernels and the other was received through the courtesy of Mr. W. J. Richards, of the Native Department. The latter strain is named "Masumbika" after the headman who is said to have introduced it upon his return from a raiding expedition into northern territory. The majority of the pods (nuts) of this variety contain two or three kernels which are considerably larger than those of the Spanish Bunch, though slightly smaller than those of the "Jumbo" variety. The skin of the kernel is light pink in colour. The average size of the pods is larger than that of the other varieties, but they are less regular in outline and shape than Spanish Bunch pods.

The new varieties were planted in duplicate plots with Spanish Bunch and Jumbo as controls. The five-kernelled strain of Spanish Bunch proved equal but in no way superior to the ordinary stock. The yield of the Masumbika variety equalled that of the Spanish Bunch in weight, but, owing to their size, it is probable that a larger proportion of the crop could be marketed as selected nuts for use by the confectionery trades at enhanced values. The Jumbo variety yielded 18 per cent. more pods than the others, but owing to its procumbent habit the nuts are scattered over a larger area and were therefore more tedious to harvest. On this account, and owing to a somewhat higher percentage of immature nuts, the value of the extra yield is partially offset. The large kernels which this variety yields make it particularly suitable for some branches of the confectionery trade, and farmers who export selected nuts may well find in it a more profitable variety to grow than the Spanish Bunch or Virginia Bunch.

Soya Bean Variety Trials.—Several new varieties were included in this season's trials, but none have yet equalled the Ototan in yield of either fodder or seed. Below, the mean yields of triplicate plots are tabulated:—

Yields in lbs. per Acre, Season 1930-31.

	Ototan.	Herman.	Biloxi.	Chiquita.	Dixie.	Chinese White.
Hay	3,690	1,936	3,630	1,331	1,149	1,331
Seed	825	495	684	488	368	458

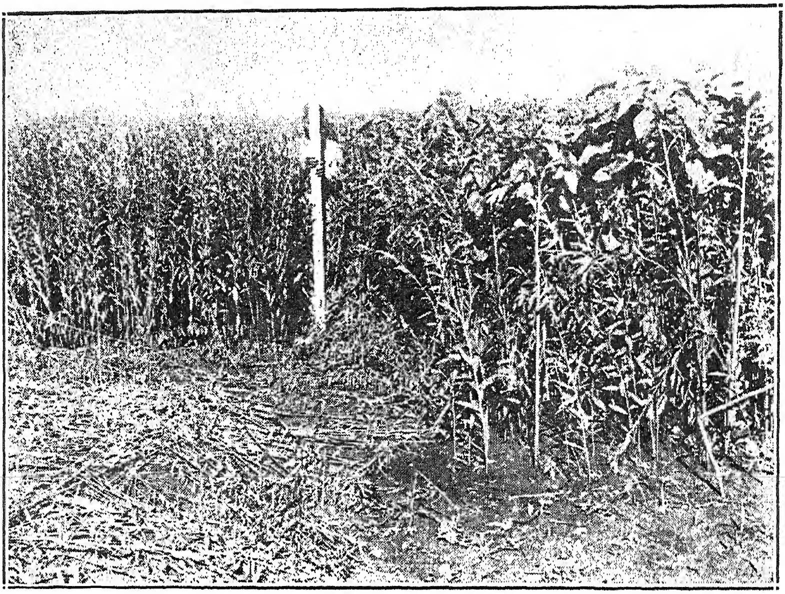
	Southern.	Virginia.	Uganda Yellow.	Uganda Black.	Soyolk.	Tokio.
Hay	847	1,210	2,420	484	968	2,089
Seed	380	345	380	143	278	698

	Morse.	Brachet.	Brown.	Mammoth Yellow.	Goshen.	Black Eyebrow.
Hay	1,089	3,160	1,149	1,210	864	1,663
Seed	418	563	420	432	220	443

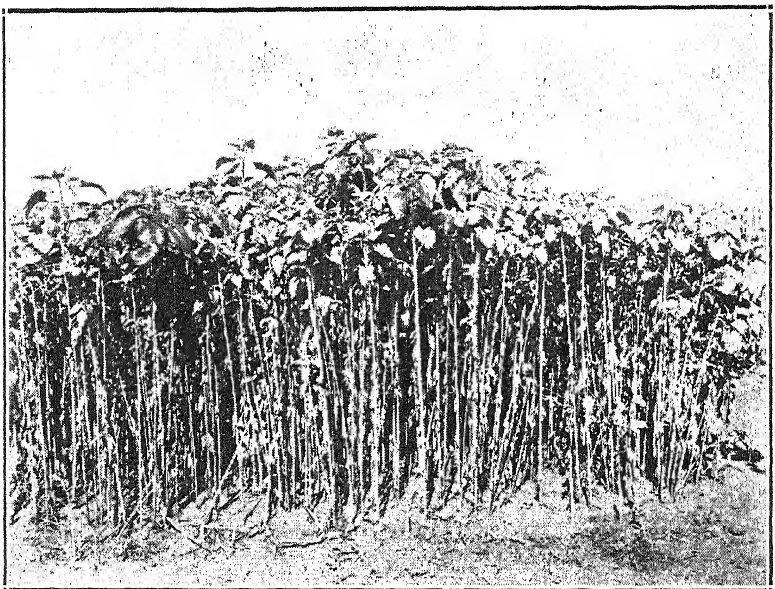
	American White.	George Washington.	Laredo.	Tarheel.	Mammoth Brown.
Hay	1,270	1,089	1,270	1,870	2,663
Seed	418	390	364	510	660

A considerable number of strains which appear to have arisen through the natural crossing of Ototan with Biloxi were segregated three years ago, and have been tested during the past two seasons. Several of these appear to be somewhat superior to either of their parents, but they need a further period of trial before more can definitely be said of them.

Sunn Hemp.—This crop has proved most valuable for use as a green manure, and although it has been sown on



Sunn hemp v. sunflower in green manure trials. Left: pure stand of Sunn hemp. Right: Sunn hemp and sunflower mixed. The two crops grow at approximately the same rate, and the mixture proves very suitable for use as a green manure, and less costly to sow down than a pure stand of Sunn hemp.



Sunn hemp v. sunflower as green manure crops. By seeding the latter at the rate of about 48 lbs. per acre a dense stand with thin stalks suitable for ploughing under has been obtained.

This experiment has failed to produce evidence in favour of pruning the crop; on the other hand, the practice appears to depress the yield.

Distance-planting Trials.—It is generally accepted that a reduced yield of seed results when a stand is either too dense or too sparse, and these trials were laid down to investigate this aspect of the problem of seed production. Seed was sown in rows at three different distances apart, namely, 9 inches, 18 inches and 24 inches, with the plants spaced at two to three inches apart in the rows in each case. The results of two seasons' trials on quadruplicate plots are shown in the tabulation below:—

Yields of Sunn Hemp Seed in lbs. per Acre.

Distance between rows.	Approximate amount of seed per acre.	Season 1929-30.	Season 1930-31.	Average two seasons.
9 ins.	36 lbs.	953	1,485	1,219
18 ins.	18 lbs.	956	1,320	1,138
24 ins.	14 lbs.	807	1,530	1,169

The yields obtained at the various distances apart and rates of seeding are seen to be approximately the same in all cases, and it would seem that within reasonable limits the density of the stand has little effect on the yield of seed.

During the early stages of growth this crop is often attacked by the leaf-eating Exosoma beetles, which, it was suggested, might be the means of transmitting a virus disease resulting in abnormal growth and low seed production. To investigate this point, duplicate plots were kept free of insects, while others were subjected to their attack. Quadrats on which "Complete" fertiliser was applied were superimposed on these trials. The whole crop grew luxuriantly and appeared normal until the flowering stage was reached, when it was observed that a large proportion of the flower-buds fell to the ground unopened, and that many of the flowers which opened were sterile. The plants behaved in this abnormal manner over the whole of the area employed for this trial, irrespective of fertiliser

treatment and protection from insect attack. Although the crop attained a height of eight feet and continued to produce flowers over a period of three months, seed production was confined to a few individual plants around the edge of the block of plots, and amounted to a few pounds per acre only. The reason for the sterility of this crop has not been ascertained, but it is thought that a seed-borne virus disease may have been a contributing cause, and possibly that the virulence of this was increased through the vitality of the plants becoming impaired by the cessation of rain at a critical stage, viz., when they were growing luxuriantly and commencing to flower.

It is noteworthy that a satisfactory crop was produced from the same stock of seed, planted on the same day on another less fertile area, and, further, that, in other seasons, a normal crop has been taken from this land, indicating that the soil did not lack any of the constituents necessary for the crop.

Heavy-bearing Strains.—Another means which is being employed to overcome the low yield problem is the establishment of individual strains from promising plants. Two years ago several strains were segregated for this purpose, and the past two seasons' results indicate that some of these are capable of yielding fifty per cent. more seed than the common variety. If next season's results are equally satisfactory, small quantities of seed will be issued to farmers for more extended trial.

In addition to these selections, some new Indian varieties have been received through the courtesy of Mr. A. S. Laurie, of Concession, which promise to yield considerably larger quantities of seed than the kind commonly grown in this Colony at present.

Wheat Varieties.—Five varieties of wheat were sown on the 30th December, 1930, and with the exception of "Mentana" all made satisfactory growth until they reached the flowering stage. Soon after that, however, they all became heavily infected with "rust," with very detrimental effect on the quantity of the grain.

Mentana and Huron failed to produce any seed, while the others yielded as follows:—Kenya B 286, 999 lbs.; Reward, 918 lbs.; Kenya Governor, 693 lbs. per acre.

Sweet Potato Variety Trials.—No new introductions of this crop having been made recently, only those varieties grown in previous years were included in the trials. The results of which, on the whole, support previous tests, though the variety known as "Linslade" has yielded even better than in previous years. This strain has produced both vines and tubers in large quantities over a period of five years, and as a dual purpose variety is possibly slightly superior to the others mentioned.

Yield in lbs. per Acre.

Name of Variety.	Average weight of tubers over 9 years.	Average weight of green tops over 9 years.
Early Butter	16,521	15,849
Calabash Leaf	12,781	20,492
Common Pink	17,233	12,715
	(over 6 years)	(over 6 years)
Linslade	17,192	18,116
	(over 5 years)	(over 5 years)
Oklahoma	9,119	13,688
	(over 3 years)	(over 3 years)
Yellow Jersey	13,744	9,017
Southern Queen	12,996	17,825
Porto Rican	8,885	13,178

For the past five years a part of each plot in the variety trials has been allowed to remain down, with the object of ascertaining the advisability of relying on a volunteer crop for the second year. It has been found that the yields of the second crops have been somewhat less than those of the first, but on the whole very satisfactory results have been recorded. The second season's tubers are usually smaller than those of the first season, and unless care is taken to reduce the stand of volunteer plants to approximately one plant to each half square yard, it may be found that the resulting return will consist of numerous small tubers whose lack of size may considerably reduce their value.

Sweet Potatoes: Volunteer Crop.—

Yield of Tubers in lbs. per Acre.

Name of Variety.	First year's crop for comparison.	Volunteer crop, 1930-31.	Average of six seasons' volunteer crops.
Early Butter	16,608	4,820	10,576
Common Pink	20,668	5,054	9,568
Calabash Leaf	10,728	5,481	5,723
Red Nancemund ...	7,536	3,948	5,759
Linslade	17,409	8,964	9,608
Oklahoma	8,337	6,426	5,091

These returns indicate that some varieties are more productive than the others during the second year, and over the five-year period, Early Butter, Linslade and Common Pink have consistently produced heavier volunteer crops than the others, thereby proving their superiority as producers of tubers, though the Calabash Leaf has maintained its lead for the production of green tops.

The yield of green tops from the volunteer crop averages slightly less than that of the first year, in spite of the advantage they have in being able to commence their growth earlier in the season.

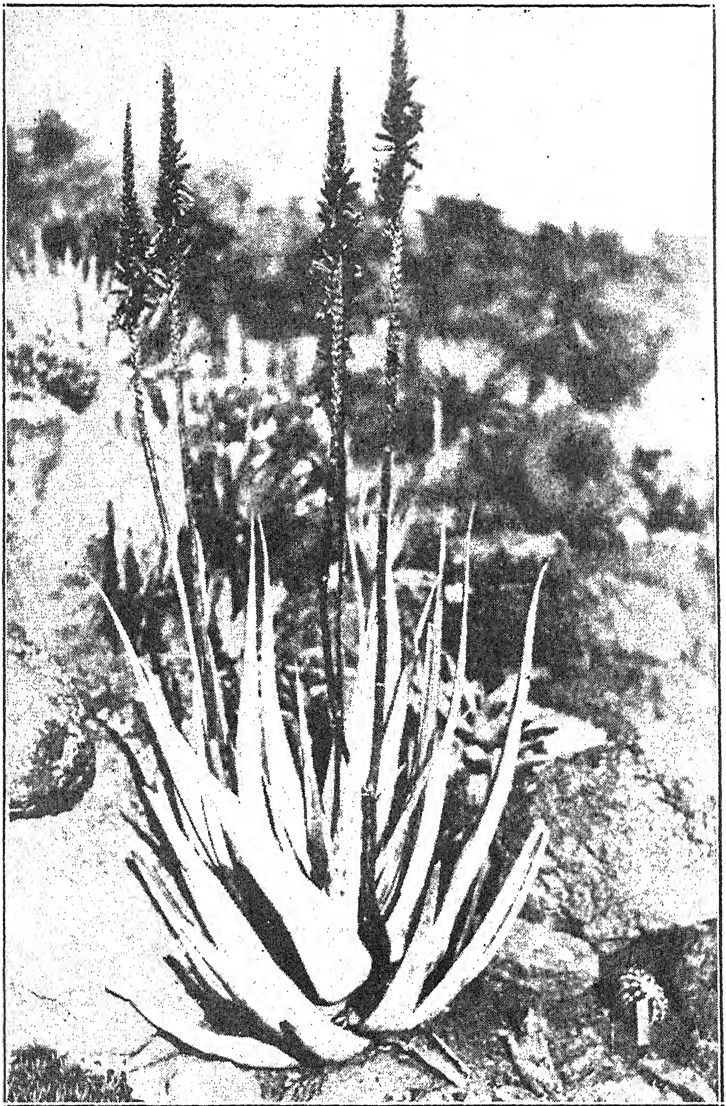
During the course of these trials it has been noticed that the foliage of a volunteer crop is more frequently attacked by insect pests than that of the first crop. This fact, combined with decreased yields and the difficulty experienced in keeping the land free of weeds, affords sufficient reason for not leaving the crop down for more than two or, at most, three seasons.

Canna and Legumes grown together for Fodder.—The succulence of the canna crop renders it a useful stock food, but in order to balance the excess of starch it contains, protein needs to be added to the ration. For this reason it was thought that by interplanting canna and leguminous fodder crops a better balanced ration might be obtained. To ascertain whether this would be feasible, cannas were planted in rows 80 inches apart by 36 inches in the rows in October, 1929, and in the following December on one half of the plot dolichos beans were sown between the rows, and on the other half a mixture of Soya beans and wedge peas.

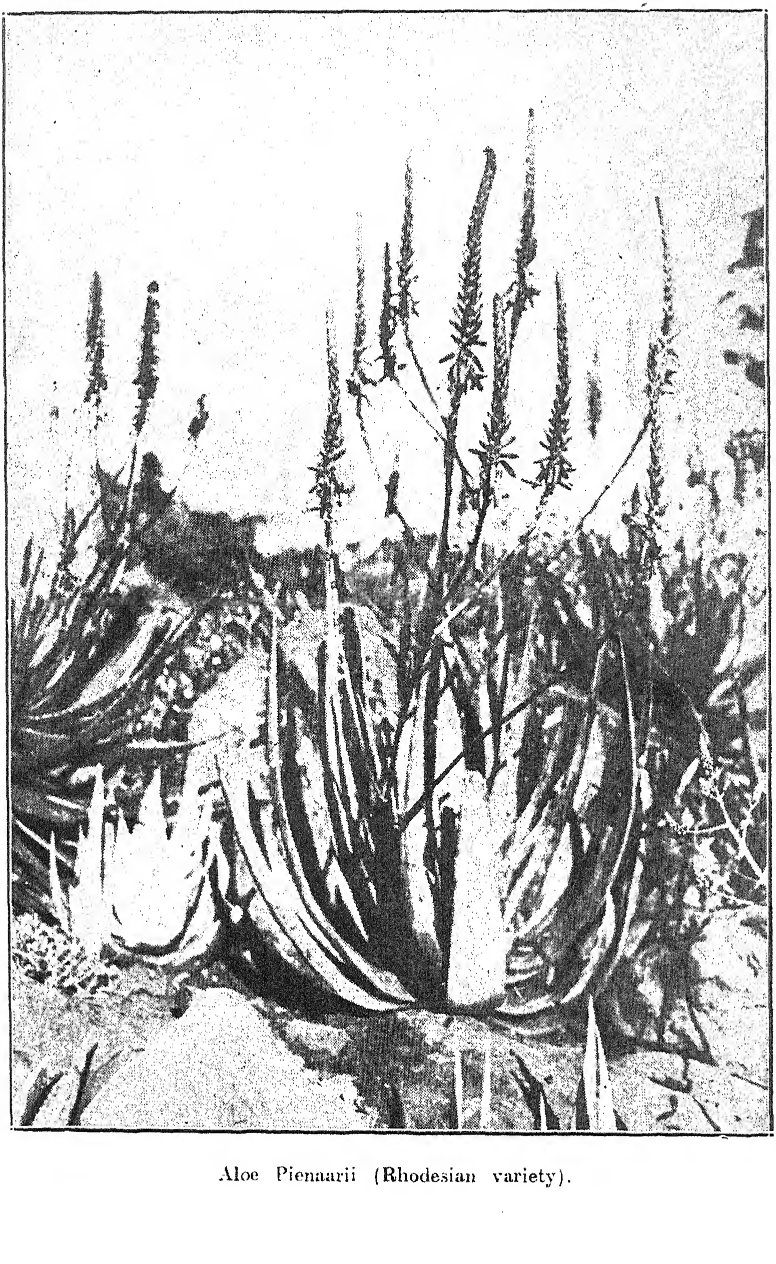
Owing to the type of growth of the plants being different, this combined system of cropping appeared to be very satisfactory. The sturdy upright growth of the canna gave shelter and support to the legumes, which, in turn, by providing a canopy over the ground, prevented evaporation of soil moisture through the action of sun and wind. The wedge pea reached its maximum growth at the beginning of March, the Soya beans were a month later and the dolichos beans remained succulent until the end of May. The legumes were cut and weighed when they reached maturity, and their yields of fresh material per acre were found to be as follows:—Wedge pea, 1,080 lbs.; Soya beans, 3,180 lbs.; dolichos beans, 4,980 lbs.; canna tops, cut 30/5/30, yielded 9,344 lbs. per acre.

The canna tubers were not lifted at the close of the first season, and legumes were again sown in season 1930-31, when, owing to competition with the previously established canna and the early cessation of the rains, the legume growth was very considerably less than that of the previous season. When it is desired to leave the canna down for more than one season, therefore, it would appear advisable to remove alternate rows after the first season, or to space the rows from 10 feet to 12 feet apart in the first instance, in order that in the second season the legume crop may be sufficiently heavy to effectively raise the protein content of the mixed fodder.

The results of the experiment indicate that this system or variations of it may well prove suitable for those who require a crop for pigs or other live stock during the period March to May or even later in frost-free situations. It appears to be particularly well adapted for pig farmers, since by this means a well balanced ration which should not require much augmentation should be provided, whereby the expense of harvesting and transporting the crops to the piggeries would be saved.



Aloe Pienaarii (Lobatsi, Bechuanaland, variety).



Aloe Pienaarii (Rhodesian variety).

NOTES ON AFRICAN ALOES.

By H. Basil Christian, Ewanrigg, Arcturus.

PART II.

Aloe Pienaarii (Rhodesian variety).—This aloe was first recorded from Smit's Drift near Pietersburg in the Northern Transvaal.

A variety of it occurs in Southern Rhodesia, and so far has been recorded from the Victoria Falls, where it occurs in considerable numbers, the Northern Umvukwes and Salisbury districts in small colonies, the lower Mazoe Valley and the valley of the Mtaradza Falls in great numbers and a small colony at the upper end of the Sabi Gorge.

It is generally found on granite kopjes often in the shade of trees, and occasionally in open, flat country.

It is one of the slowest growing of all aloes, and does not throw out suckers from its base.

It is an acaulescent plant, or with a short stem, having long, narrowish dark green leaves and with up to four branched chocolate-coloured peduncles.

The flowers of the type are at first scarlet, greenish at the tips, which become citron yellow when open.

The Southern Rhodesia variety has longer racemes not so densely flowered as the type. The colour of flowers a darker red, greenish at tips, which hardly change to yellow.

In Southern Rhodesia the flowering period is from June into August.

Aloe Pienaarii (Lobatsi, Bechuanaland, variety).—This aloe occurs near Lobatsi, Bechuanaland, and differs from the type in having light glaucous green leaves similar to *A. Wickensii*.

The racemes are densely flowered as in the Transvaal species, and differ in this respect from the Southern Rhodesia variety.

The perianth when open becomes yellow for about one-third of its length.

It flowers in July and August.

Aloe Wickensii.—This aloe occurs in M'Phathlele's location, N. Transvaal. In habit of growth and shape of leaves it much resembles *A. Pienaarii,* but the colour of the leaves is a pale glaucous green.

The inflorescence often consists of 2-4 flowering stems from same rosette of leaves.

The peduncles are chocolate brown in colour.

The perianths are at first red, becoming bright lemon yellow when open, which makes it a much more striking-looking aloe than *A. Pienaarii,* which it so much resembles. Like the latter, it is very slow growing, and does not throw out suckers.

Flowering period in Southern Rhodesia July into August.

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

Aloe Wickensii.

POULTRY INDUSTRY.

CARE OF YOUNG STOCK IN HOT WEATHER.

By H. G. Wheeldon, Chief Poultry Officer.

Chicken Flagging.—A steady, sustained growth from start to finish in the season's young stock is of such great importance that no one can afford to allow it to lapse. The first two or three weeks may be said to cover a critical stage in the life of the chick, and having survived that period, chicks should grow steadily, if assisted by favourable environmental conditions and, of course, generous and judicious feeding. Steady, normal growth in warm weather is largely dependent upon hygienic conditions, ample ventilation and room in the sleeping quarters, with spacious yarding or free range facilities.

During the hot weather one frequently hears complaints to the effect that the chickens have stopped growing. They have ceased to make visible progress day by day and seem listless and wanting in vigour. In the case of chickens that have just completed growing their first plumage, a temporary cessation of growth may be expected; this is transitory and soon passes, but that which is referred to here as "flagging" may occur at earlier or later stages, and may be brought about by various causes. In examining this condition it is necessary to generalise to some extent on the more common causes, as there are so many varying conditions under which chicks are raised that no hard and fast rule can be laid down to cover all the conditions.

Young chickens will flag if kept confined to the brooders and brooder runs longer than is necessary in warm weather. The inexperienced rearer frequently overlooks the fact that the brooding methods and conditions that have served the

purpose very well a few weeks previously in the cold weather may be quite unsuited to the warmer months. A lack of ventilation or overcrowding the sleeping quarters are probably the most common causes of flagging amongst young and old chicks in warm weather. The atmosphere in the sleeping quarters at night should not be moist, hot or sweaty, as this indicates insufficient ventilation, which will in due course cause exhaustion, followed by flagging. This overcrowding not only retards growth, but it is conducive to catarrhal troubles. A common complaint often called "Summer colds" is frequently the result of too close confinement and overheating in the brooders or colony houses due to improper ventilation. The sleeping quarters should be inspected two or three hours after dark, when the necessary final adjustments can be made for the night.

Chickens may become droopy and listless through monotony; this is brought about by too close confinement in the same runs week after week or on stale ground, which is apt to check the growth of chicks as effectively as improper feeding. During the closing period of the breeding season, especially when large numbers of chicks have been raised on the same ground, it would be to their advantage in warm weather to adopt colony houses for free ranging the young stock on fresh ground. Growing stock require liberal range, and where available a shady grass-covered field, previously mowed, would furnish suitable conditions. Access to an orchard will also provide shade and other essential requirements in hot weather. If free ranging conditions are not available, care should be exercised to avoid overcrowding the runs. A common error under semi-intensive conditions is over-stocking the poultry plant. Rigorous culling and confining the stock in small rather than large numbers together cannot be too strongly emphasised if the healthy growth of chickens is to be maintained. There are other contributing causes of unthriftiness which may be overlooked, such as insufficient food, the confining together of chicks of various ages and sizes, neglect to separate the sexes, insect vermin and lack of cleanliness. The consistent maintenance of cleanliness in the brooders, houses and runs is an important essential for the well-being of growing stock. Insect vermin become very active as the

weather warms up, and will soon cause droopiness and an unthrifty condition in an otherwise healthy flock of chickens. Lice and red mite will attach themselves to the head and body of the chicks and sap their vitality. The natural method for all birds to suppress and free themselves of vermin is by dust-bathing; provision in this respect should be made to enable the chicks to dust themselves or wallow in moist soil; this, in addition to general cleanliness, is the best preventative. Failing this, the spraying of coops and treating the birds with insect powder should become a regular practice in the management when lice and other insect vermin have made their appearance. As far as possible, chicks of the same age and sex should be housed together in groups not exceeding 50 birds. The cockerels should be housed in separate runs or on range away from the pullets.

The remedies for flagging in young stock are obvious. Chicks that do not "get on" often derive some stimulus by a change to larger premises or moving them to fresh ground, and a change of food, such as moist mash, occasionally acts like a tonic. A little raw minced meat and plenty of succulent green vegetable food or young onion tops may be included also as part of the bill of fare for chicks hatched at the end of the season. A regular supply of green food is important in warm weather. The object of the poultry farmer to-day is to economise in almost every branch of this business, but there is one place where stinting is false economy, and that is in the feeding. It is important to hatch and rear the number of stock that can be fed and reared properly. It is much better to hatch fewer birds and feed them well rather than a large number which are likely to be underfed.

Sanitation.—Sanitation checks disease and must be regarded as one of the important considerations in successful chick rearing. Many common diseases and troubles of both old and young stock can be avoided by following sanitary principles. Proper sanitation means raising chicks on fresh ground by moving the brooder from place to place or digging over and cropping contaminated ground, or the permanent rearing pens in the off-season, cleaning and renewing the litter as may be necessary, consistent cleaning

of the utensils and disinfecting the brooders after each lot of chicks are weaned.

Cannibalism or Toe Picking.—Cannibalism is often associated with poor hatching or close confinement in the brooders of young chicks, and is often brought on in older chicks by a lack of exercise and animal food or other deficiencies in their ration. Much of this trouble can be avoided by brooding chicks in small lots or by getting them out of doors as much as possible, by giving them proper nutrition and providing them with some means of keeping them busy. Plenty of protein and green food are essential; sprouted cereals in a little soil contained in a shallow, wire-covered box and placed in the chick runs or brooder house will help to keep the chicks busy.

Attention to Details.—Chicks are delicate during the early period of their life, especially in cold weather, and attention to details will count in their successful care. Recommendations in the care and management will not give satisfaction without the use of good judgment on the part of the attendant. Any methods which have proved satisfactory in the past should be carried out with a definite plan in the management.

In the rearing of chickens common sense and observation are particularly important to prevent mortality and raise to maturity profitable layers for the future.

SOME CONSIDERATIONS ON QUALITY IN WHEAT.

By H. WENHOLZ, B.Sc.Agr., Director of Plant Breeding, New South Wales.

From the time William Farrer supplanted the very late soft wheats of low quality in Australia with Federation and other varieties of better quality at the beginning of the present century, there has been a growing interest in the quality of Australian wheat. Despite the production of Farrer wheats of very high quality, such as Comeback, Bobs, Cedar, Jonathan, etc., these varieties never made much headway in commercial culture against the more productive varieties (Federation, Yandilla King, etc.) of medium weak or medium strong flour quality, which at present constitute Australian wheat.

Because of changes, chiefly in the direction of greater mechanisation in the baking industry, which have taken place throughout the world in recent years, the demand for wheat or flour of high baking quality has become more widespread, and this demand is now becoming more insistent in Australia. Every now and then millers, merchants and bakers handle a sample of Comeback or some other variety of specially high quality grown for show or special exhibition purposes in Australia, and realising its excellent baking value, urge farmers to grow such wheat commercially.

The whole question of wheat or flour quality is of such wide interest and is receiving such general attention that the wheat breeder, who really holds the key to the future situation as to the quality of new varieties, is justified in examining the position in Australia in the light of recent developments and in taking whatever action seems necessary or advisable.

Conflicting Interests.—On account of the present low world prices for wheat, the Australian wheat-grower is in the midst of (or, it is hoped, is passing through) one of the most difficult periods of his career, and he needs now, more than ever, every possible political, economic, technical and practical assistance, in addition to the greatest efficiency on his own part, to make wheat-growing profitable or to enable him to remain in the industry.

The particular variety or varieties of wheat grown play a big part in the wheat-grower's profits or returns from his crop, and he needs to make his choice of these varieties with the greatest consideration. In Australia, wheat is not graded for market, but is sold on an f.a.q. (i.e., fair average quality) standard, based almost entirely on bushel weight. Wheat that has a lower bushel weight than the f.a.q. standard is subject to price dockage, but the grower does not get any premium for wheat of higher bushel weight than the f.a.q. standard. The milling quality, a term which has been used in Australia as synonymous with baking quality, is not considered in determining the f.a.q. standard, and, except in a few instances, millers do not generally give any premium for wheat of high flour strength or baking quality. The farmer's chief consideration, therefore, in the choice of a variety is bushels per acre. The only other consideration is that the grain should not, if avoidable, suffer damage or deterioration from disease (rust, smut, etc.) drought, weather damage (bleaching, etc.), which will decrease its bushel weight below that of the f.a.q. standard.

The grain merchant naturally likes to handle as much grain as possible above f.a.q., for which he seldom pays an increased price, as it can, if desired, be blended with wheat below f.a.q. purchased at a lower price to make an f.a.q. sample. He is also naturally interested in wheat of high flour quality, since most of his sales go eventually to millers chiefly overseas, who desire a general improvement in flour quality. The local flour miller usually buys his requirements direct from the farmer.

The miller is chiefly concerned with the cleanliness, soundness, plumpness and brightness of the grain, which

he desires to be easy to mill and to yield a high percentage of flour, if possible, of good baking quality.

The baker desires a flour of standardised or uniform quality, of good colour and of high water absorption from which a large number of loaves can be made from a given weight of flour, and which is also capable of giving a loaf of large volume and of good texture.

Each of these people look to the wheat breeder to evolve the type of wheat they desire, without much thought or consideration for the other people concerned. The breeder must give serious consideration to the type of wheat evolved, and it is his duty to bring about some measure of unity, if possible, between these apparently different or conflicting requirements of the farmer, grain merchant, miller and baker. Since it takes about ten or fifteen years from the time a cross or selection is made by the wheat breeder before the new variety comes into general cultivation, a heavy responsibility thus rests on the breeder, and his efforts must be directed as early as possible into the wisest course.

There are many other characters which the breeder must consider in breeding new varieties of wheat, such as disease resistance, strength of straw, grain holding capacity, drought resistance, etc., but we are dealing here with the question of grain or flour quality, and we shall attempt to see how far it seems possible to secure the compatibility of all interests in a breeding programme.

To begin with, let us try and understand more clearly what is involved in the term quality or strength, as applied to wheat grain or flour.

Character of Grain and Baking Quality.—The baking quality of wheat flour is generally defined as its capacity to produce loaves of large volume and of good texture and colour. It is well known that the most important factor in the determination of flour quality or strength is the gluten, in which the nitrogenous portion of the flour is chiefly contained. It is not only the quantity of gluten, but also (perhaps chiefly) its quality, which is of importance in determining the baking quality or strength of the flour. A flour which contains a large quantity of gluten of good

quality has a capacity to absorb a large quantity of water, and also yields dough which is sufficiently tough and elastic to stand a large amount of kneading, and also to be capable of holding the gas generated in the leavening process.

To explain most simply the effect of gluten on baking quality, the gluten may be regarded as comprising the walls of a cell which is being subjected to pressure from within by the expansion of gas created by the yeast organisms in the dough. A low percentage of gluten in the flour means that the cell walls are thin, and not being able to withstand a high pressure, give way and allow the gas to escape. Such a flour does not make a loaf of good volume. A high percentage of gluten in the flour will give thick cell walls, which may stand pressure well and give a well risen loaf. The gluten may, however, be present in sufficient quantity to make thick cell walls, but it may be of poor quality, having insufficient elasticity to stand much stretching without breaking. In this case also the gas escapes and the resultant loaf is not of large volume. A high pressure is tolerated by cell walls of high elasticity, which accompany gluten of good quality. The highest loaf volume and the best loaf texture are therefore generally attained with flour containing a high percentage of gluten of good quality.

The appearance and texture of the grain bear some relation, but are only a rough guide, to the quantity and quality of the gluten it contains. Soft wheat is of opaque appearance and of low gluten content, and being generally also of low gluten quality it is of poor baking quality, and is said to possess weak flour. Hard wheat is generally of horny, translucent or vitreous appearance (though some hard grain may be dull and opaque). It cannot be assumed, however, that all hard grain has the highest quantity or quality of gluten. It is for this reason that tests are necessary to determine both the quantity and quality of gluten in wheat. Strong flour wheats are those which are good in both these characters and which are therefore of good baking quality.

The protein content of the grain, however, bears a close relation to the quantity of gluten contained in the flour. High protein wheat is considered in U.S.A. to be so

generally indicative of good baking quality that premiums are paid for such wheat in that country.

Factors Influencing Grain Quality.—The term quality as applied to grain may here be taken to mean the baking quality of the flour milled from it. Thus, grain quality depends on both the quantity and quality of its gluten. The actual quality of the grain produced is determined by both heredity and environment, i.e., chiefly by the kind or variety of wheat and the climatic and soil conditions under which it is grown.

There is reason to believe that quality of gluten is an inherent character which is not modified to any appreciable extent by environment. On the other hand, the quantity of gluten in a sample of wheat is determined both by environment (chiefly climate) and by heredity (the variety). Durum or macaroni wheats are generally of comparatively high protein or gluten content, but the quality of the gluten is usually poor. The protein content of these wheats is influenced to some extent by the climate in which they are grown, but the climate has no appreciable effect on the quality of their gluten. The original Red Fife wheat of Canada has gluten of inherently good quality, and this character has been transmitted to many of its offspring, e.g., Marquis, Reward, Garnet, Yeoman, Comeback, etc. The protein or gluten content of these wheats is generally good, but it is influenced markedly by climate. The climate has probably a greater influence than that of heredity (variety) on the protein or gluten content of the wheat, but its influence on gluten quality is insignificant by comparison with that of the variety or kind of wheat.

Climate is the chief factor in the environment which influences grain quality and texture. Wheat grown in countries or districts where the maturing period is prolonged by cool moist conditions is soft in texture and poor in gluten content in comparison with the hard wheat produced in warmer and drier regions. The slow ripening prolongs the retention of chlorophyll and the elaboration of starch and its translocation to the grain, while quick ripening tends to prevent this, and the diminished starch content promotes a higher protein content and a harder grain. Thus late-maturing wheats tend to be softer than early-maturing

wheats, but the texture and quality of the grain are more greatly influenced by the period of kernel development than by the total length of the growing period.

Of course it must be realised that a prolonged ripening period which favours the production of soft grain also corresponds with high yields, and it therefore seems that high yields and high quality grain are not compatible. Any attempt by the breeder to increase the quality of wheat too greatly may therefore result in loss of yield. This would probably be the case, especially in late-maturing varieties or in cool districts.

Soils rich in nitrogen naturally tend to produce harder grain of higher nitrogen content than soils poor in nitrogen, unless they favour high moisture retention and slow ripening. The application of nitrogenous fertilisers has a similar effect in some countries. Similarly, soils in which nitrification is active yield better quality grain than those of poor nitrifying character, and for this reason fallowed land generally produces grain of somewhat better quality than stubble land of similar character. The intake of nitrogen by the plant during its growth (especially during its early growth) also influences the protein content of the grain, and this is why, other things being equal, a mild dry winter gives grain a better quality than a cold wet winter—really a question of nitrification in the soil and the abundance and availability of nitrogen to the plant in its early growth. (N.S.W. Ag. Gaz., August, 1932.)

THE TREATMENT OF INTESTINAL PARASITES OF SHEEP.

By J. D. Coutts, M.R.C.V.S., D.V.S.M.

The great drawback to successful sheep farming in this Colony is the loss of animals due to the ravages of gastro intestinal parasites. The infection is gathered by the animals while grazing.

The internal parasites with which we have to deal do not multiply within the alimentary canal of the host. Thus the degree of infestation of the host is directly proportional to the degree of infection existing on the grazing ground.

It will, therefore, be apparent that whatever therapeutic treatment is adopted must be palliative only, unless adequate measures to reduce the number of viable larvae in the veld are undertaken at the same time.

As far as is known at present, probably the most satisfactory combination of drugs used for the control of internal parasites of sheep is a mixture of the following:—

Carbon Tetrachloride	3 c.c.
Oil of Chenopodium	2 c.c.
Copper Sulphate	20 grains

The above is the dose for an adult sheep in fair condition. Half the above quantities may be used for lambs six months old and over. For lambs six weeks to six months old 5 grains of Copper Sulphate only is used.

The above doses should be given in one ounce or more of water.

Precautions to be observed in dosing.—For at least a fortnight prior to treatment a bone flour lick must be fed to the flock. A suitable lick is composed of: Bone flour, one part, and coarse salt, four parts.

The doses mentioned above are the maximum tolerated, and the greatest case must be observed in measuring and in weighing out each dose.

Not more than five animals from a flock should be dosed until it is shown that they can stand the treatment. Care should be exercised in the dosing, the mixture to be thoroughly shaken up and administered slowly.

Old and debilitated animals are not suitable subjects for treatment, and if dosed are likely to collapse. After dosing, lambs frequently show marked tympany, but this condition shortly disappears.

Animals need not be starved prior to treatment.

Interval of Re-dosing.—It is believed that the control of the stomach worm is the all-important factor, and with this object in view, the dose of Copper Sulphate may be repeated at seven-day intervals to all adults in which diarrhoea persists, and to all lambs which have lost their bloom. The other drugs must not be repeated.

It is well to remember that the internal parasites of sheep are similar to those found in cattle, and unless the treatment of all herbivora which graze the same veld (particularly the young calves) is undertaken at the same time, and in conjunction with adequate measures to reduce the number of viable larvae in the veld, the complete eradication of these parasites cannot be hoped for.

The above mixture is unsuitable for calves.

AGRICULTURAL STATISTICS FOR THE SEASON 1930-31:

(a) LIVE STOCK; (b) CROPS GROWN BY EUROPEANS IN SOUTHERN RHODESIA.

Compiled by the Government Statistical Bureau.

[The following particulars have been taken from the report of the Government Statistical Bureau in regard to live stock and crops grown by Europeans in Southern Rhodesia for the season 1930-31. The complete report will be published in the usual form later in the year, but it is anticipated that the following extracts will be of interest to readers.—Ed.]

(a) LIVE STOCK.

In reviewing the statistics collected relative to the live stock of the Colony at 31st December, 1931, and the industries connected therewith, the main feature is the complete stoppage of the cattle trade due to the outbreak of foot and mouth disease.

These restrictions are responsible for a considerable increase in the total number of cattle, the total number of European-owned cattle having increased by 43,818 or 4.8 per cent., compared with 8,180 or 0.9 per cent. in 1930. Pure-bred cattle decreased by 1,643 head, but this is probably due to the fact that some farmers have been entering their grade cattle under this heading, as details of grade cattle were obtained separately for the first time in the year under review. As in previous years, the figures given for European-owned stock are exclusive of small urban owners and transport cattle employed on mines, roads and kindred activities. Native-owned cattle, as estimated by the Native Department, show an increase of 4.5 per cent., compared with 4.2 per cent. in 1930. Amongst small stock, poultry

show a substantial increase, but sheep, goats and pigs show decreases.

As regards the dairy industry, it is satisfactory to note that there were increased sales of milk and butter. The amount of cream and cheese is slightly less than in the previous year.

Of other farm products, eggs, bacon and ham and wool all indicate increased production.

Cattle.—The total number of cattle returned as owned by European farmers and ranchers was 954,161; the number of cattle owned by natives, according to estimates supplied by the Native Department, amounted to 1,628,299, making a total for the Colony of 2,582,460, compared with 2,468,418 in 1930.

The increase among European herds amounted to 43,818 or 4.8 per cent., a result which has already been commented upon.

Local consumption for the year shows a decrease, the total being 82,683, compared with 108,643 head in 1930, a decrease of 25,960 or 24 per cent. Of the above total 75,486 were slaughtered by butchers and 7,197 on farms.

The total number of deaths reported during the year under review was 58,124, a total death rate of 6.1 per cent. compared with 41,009 in 1930, representing a rate of 4.5 per cent. There were more deaths from poverty, the total being 29,346, compared with 10,843, and the rate increased from 1.5 per cent. to 3.1 per cent. The numbers under the heading "deaths from disease" rose from 17,159 to 19,297 in 1931. Deaths from accidents and wild animals show a decrease of 232.

In addition to the losses from deaths, 4,156 head of cattle were reported as lost or stolen during the year, an increase of 379 on those shown under this heading in 1930.

Imports and Exports.—Owing to the outbreak of foot and mouth disease in April, there was practically no trade in cattle during the remainder of the year.

Number of Cattle Owners.—The total number of cattle owners at the end of 1931 was 2,821 compared with 2,660 in 1930.

Pure Bred Cattle.—The number of cattle classed as pure bred show a decrease of 1,643 head or 10.7 per cent., compared with an increase of 551 or 3.8 per cent. in 1930. This decrease is in all probability due to the practice adopted by some farmers in previous years of including high grade stock under the heading "pure bred." This decrease is particularly noticeable in the case of Frieslands, the total number of this breed shown as pure bred having dropped from 3,898 to 2,518 head.

Grade Cattle.—The number of grade cattle was asked for in the returns for 1931 for the first time.

The total number was 122,306, of which 60,364 were cows, 28,661 were heifers over one year, 28,997 calves under one year, 2,977 bulls in use and 1,307 other bulls.

Equines.—During the period under review European farmers owned 2,618 horses, 1,450 mules and 11,795 donkeys.

Sheep.—European farmers owned 86,732 sheep in 1931, which was a decrease of 4,747 on the previous year's figures. The native-owned sheep show a substantial increase from 268,880 in 1930 to 288,770 in 1931.

The total death-rate amongst European-owned animals (exclusive of animals lost) was 14.4 per cent., compared with 10.8 per cent. in 1930. The death-rate from disease was 8.0, compared with 7.3 per cent. The local consumption was 42,297, of which 37,880 were slaughtered by butchers and 4,417 on farms.

The number of sheep imported was 26,642, a decrease of 3,552 and the exports totalled 743, a decrease of 2,807. Exports of skins show a decrease, the total weight exported was 60,854 lbs., valued at £1,325, compared with 122,884 lbs., valued at £2,286 in 1930.

The total number of farmers owning sheep was 818, of which number 284 had flocks of 100 animals and over. Forty-five farmers reported a clip amounting in the aggregate to 62,145 lbs.

Goats.—The total number of goats owned by European farmers shows a decrease from 9,636 in 1930 to 8,606 in 1931. The number of native-owned goats, on the other

hand shows an increase from 752,295 in 1930 to 761,583 in 1931.

Pigs.—The number of European-owned pigs showed a decrease from 25,536 in 1930 to 22,085 in 1931, whereas the number of native-owned shows an increase from 40,946 in 1930 to 45,795 in 1931.

The local consumption showed an increase from 18,323 in 1930 to 20,207 in 1931.

ANIMAL PRODUCTS MADE AND SOLD.

(1) **Milk and Milk Products.**—*Milk.*—The sales of milk as milk reported by farmers amounted to 1,182,366 gallons, as compared with 1,008,854 gallons.

Cream.—Sales of cream reported by farmers totalled 234,418 gallons, which when compared with the cream bought by creameries appears to be slightly under-stated.

Butter.—Farm butter sold amounted to 442,815 lbs., compared with 403,780 lbs., an increase of 39,035 lbs. Butter produced by creameries amounted 1,377,105 lbs., compared with 1,364,921 lbs. in 1930, an increase of 12,184 lbs. Exports of butter amounted to 645,247 lbs., valued at £45,072. Imports amounted to 101,005 lbs., valued at £6,661.

Local consumption of butter, calculated on the basis of production and stocks at beginning of year, plus imports, minus exports and minus quantity in cold storage at end of year, gives a figure of 1,210,214 lbs.

Cheese.—The production of cheese in 1931 amounted to 146,261 lbs., compared with 163,382 lbs. in 1930. Imports amounted to 178,032, and exports to 13,474 lbs., the total consumption for the year amounting to about 310,819 lbs.

(2) **Other Animal Products.**—*Pork Products*—Bacon, etc.—The total amount of bacon and ham produced by the factories was 459,593 lbs., an increase of 37,728 lbs. on the production for 1930. Bacon and ham produced on farms amounted to 41,955 lbs., an increase of 11,408 lbs.

Imports amounted to 302,342 lbs. and exports amounted to 77,779 lbs.

Sheep Products.—Wool: The total clip of wool reported by farmers was 62,145 lbs., an increase of 1,898 lbs. Exports of wool amounted to 35,028 lbs.

Poultry.—The number of birds owned by farmers has increased from 258,399 in 1930 to 268,711 in the year under review.

Although this total includes all the larger poultry breeders, it by no means represents the total number of poultry in the Colony, as it does not include small owners in towns and urban areas.

Imports of live birds amounted to 15,601 in 1931, compared with 15,122 in 1930, while exports were 15,044 in 1931 and 9,227 in 1930.

The total number of farmers reporting poultry is 2,230, and of this total 1,117 reported sales of eggs, while 332 had sales of 500 dozen and over.

Eggs.—The total sales of eggs by farmers show a considerable increase in this branch of farming, the total reported amounting to 845,640 dozen, as compared with 725,964 dozen in 1930. Imports of eggs amounted to 155,649 dozen, valued at £10,261, compared with 113,194 dozen, valued at £8,499 in 1930. Exports of eggs increased from 368,723 dozen in 1930 to 384,052 dozen in 1931.

(b) CROPS GROWN BY EUROPEAN FARMERS.

During the season under review there was a deficiency of rain in most districts during the planting and growing periods, which affected crops to their disadvantage.

The parasite witch weed appears to be spreading and has become a menace in some areas.

The outstanding features are:—

(1) The continued decrease in the acreage planted to maize, combined with a decreased yield per acre;

(2) increase in the acreage planted to tobacco;

(3) increase in land planted for green manuring, the acreage under which has nearly doubled itself again;

(4) increased acreage planted to subsidiary crops, notably leguminous crops.

Area under Cultivation.—The total area under summer crops during the season under review was 403,195 acres, as compared with 417,984 acres in 1929-30. The decrease is mainly accounted for by the smaller acreage planted to maize.

Green Manuring.—One of the most striking features of the year is the large increase in the acreage planted to green manure crops, and it is apparent that the benefits accruing from this form of soil enrichment are at last being realised.

The increase in the total leguminous crops is indicated by the following figures:—1927, 4,074; 1928, 4,972; 1929, 11,427; 1930, 19,791; 1931, 34,948.

Summer Crops.—*Maize.*—The total maize harvest was 1,436,644 bags from 273,372 acres, a decrease of 44,316 acres and 480,608 bags, compared with the previous year. 40.4 per cent. of the total crop was grown in the Mazoe area, 15.3 per cent. in the Salisbury area and 12.6 per cent. in the Lomagundi area.

Number of Maize Growers.—An analysis of the returns dealt with shows that 2,238 farmers out of a total of 3,100 grew maize, or a percentage of 72.2 per cent. compared with 76.1 per cent. in 1929-30.

Maize Graded for Export.—The amount of the 1930-1931 crop graded during the current season was 663,592 bags, as compared with 872,441 bags (1929-30 crop) graded during the previous season.

Ground Nuts.—There has been a slight increase in the land planted to this crop, but the yield per acre which showed a tendency to improve in 1929-30 has again dropped to eight bags or about half the acre yield obtained in the main ground nut producing countries.

Maize Silage.—This valuable fodder crop continues to occupy the premier position amongst crops grown for this purpose. The total acreage reported was 13,603 acres, compared with 11,101 acres in 1929-30. The yield of 35,223 tons or 2.6 tons per acre is slightly less than that obtained in the previous season, when the acre yield was 2.9 tons.

In addition to the maize grown specially for this purpose, a large tonnage is reaped from land planted for purposes of

grain, mainly by cutting the tops. During the year 7,192 tons were obtained from this source, compared with 7,437 tons in 1929-30.

The total maize silage produced amounts, therefore, to 42,415 tons, compared with 40,565 tons in the previous season.

Veld Hay.—In addition to the crops specially grown for fodder purposes, considerable quantities of veld hay are cut each year. During the year under review 45,860 tons were stated to have been cut by farmers, an increase of 4,071 tons on that cut in 1929-30.

Cotton.—A total area of 8,979 acres was planted to this crop and the yield amounted to 2,606,890 lbs of seed cotton, or 290.3 lbs per acre.

Tobacco.—With the improvement in the market there has been an increase in the land planted to this crop.

The total area planted in 1930-31 amounted to 16,145 acres, of which 15,317 acres grew the Virginian type and 828 acres the Turkish variety.

The total production amounted to 8,644,390 lbs., of which 8,268,926 lbs. was Virginian, etc., leaf, and 375,464 lbs. Turkish leaf; the greater bulk is stated to be flue-cured. There was a considerable increase in the amount of fire-cured tobacco, but the production of Inyorka and kaffir tobacco was reduced.

Tea and Coffee.—These two crops are making steady progress, though both industries are in their infancy.

During the 1927-28 season the total yield of tea was estimated as 5 lbs. and of coffee probably about 400 lbs. During the season under review 3,860 lbs of tea were produced and 5,500 lbs of coffee.

Winter Crops.—The total area in Southern Rhodesia devoted to the raising of winter crops is still comparatively small, amounting to 13,896 acres, which, however, is an increase of 2,182 acres, or 19 per cent. on the area planted in 1930. The increase is mainly in land planted to wheat, which in 1931 amounted to 8,631 acres, or 62 per cent, of the total acreage under winter crops during the year. Owing to the absence of rain during the growing period these crops

are grown either under irrigation or on the moisture-retaining vleis situated principally on the sand veld. As wheat is principally grown under the latter conditions, it would appear that the employment of irrigation for producing crops during the winter months is not being developed to any great extent.

The total number of farmers who are engaged in growing winter crops is only 755, or 24 per cent. of the farmers in the Colony. Taking 10 acres as the minimum for a farmer who may legitimately be considered as a producer of winter crops, only 322, or 10 per cent. of farmers came within this category. Nearly 50 per cent. of these are in the districts of Charter, Salisbury and Melsetter, these districts also accounting for 47 per cent. of the total acreage under winter crops.

Potatoes.—The total area planted to winter potatoes was 1,152 acres, compared with 871 acres in 1930.

The summer crop yielded 29.4 bags per acre, which is the highest yield on record, and the winter crop 26.7 bags, compared with corresponding acre yields of 26.1 bags and 20.5 bags in 1930.

Onions.—Only small acreages of this crop are grown. The area devoted to onions in the year under review was only 97 acres, which yielded 3,441 bags.

Wheat.—The total acreage planted to this crop was 8,631 acres compared with 6,911 in 1930, the yield per acre being 2.3 bags.

During the last five years the Rhodesian wheat crop has only averaged 14 per cent. of the total consumption in the Colony.

Oats.—The total acreage planted to this cereal was 2,121 acres compared with 2,193 acres in 1930.

Barley.—The total acreage planted to barley was 1,778 acres, and this showed an increase of 300 acres.

Rye.—Small acreages only are grown; during the season under review 87 acres were planted and 66 bags of grain were reaped from 52 acres, and 39 tons of fodder from 35 acres.

Fruit.—The total number of bearing fruit trees has shown a considerable increase during recent years. During

the season under review it is estimated that 64,743 deciduous fruit trees and 159,424 citrus trees were in bearing in the Colony.

Forestry.—Afforestation has during the year under review received increased attention, the total area reported being 18,167 acres, compared with 17,858 acres in 1929-30.

The main increases were in the Umtali, Chilimanzi, Salisbury and Marandellas districts. The two former districts increased from 987 acres and 413 acres respectively in 1926 to 5,142 and 1,845 acres in 1931. In both these districts there are large Government afforestation schemes, the Stapleford Forest Reserve being in the Umtali district and the Mtao Forest Reserve in Chilimanzi. Salisbury increased its acreage from 960 acres to 2,529 acres during the same period and that of Marandellas rose from 1,338 acres to 2,903 acres.

FARMING CALENDAR.

October.

BEE-KEEPING.

Bush bloom is now on, the queens consequently are laying vigorously, therefore give space and ventilation. In good districts, where stocks are strong, nectar may be coming in freely, and to prevent swarming it may be necessary to remove a crate of honey. By using the carbolic cloth, the operation is easily and quickly accomplished. At this season, whenever a crate of honey is removed, a properly fitted empty crate must take its place, otherwise the bees will swarm. Keep the apiary clear of weeds, and all hives well shaded. Feed any weak stocks.

CITRUS FRUITS.

Citrus trees should not be permitted to suffer for want of water if a good setting of fruit is desired. Continue irrigation at fairly frequent intervals, especially if it is windy. Cultivation must follow each irrigation when the soil is fit to work, otherwise a large amount of moisture will be lost by evaporation. The packing of late fruit for export should be completed early in the month or before the rains commence. If rains intervene, the carrying properties will be affected and the fruit will probably break down in transit. Suppress all stem growths or water shoots as they appear. Young trees planted last season may with advantage have the stems whitewashed or washed with Bordeaux mixture paste; this will prevent undue sun-scalding of the unprotected stems. Plant cover crops with the first good rains.

CROPS.

If not already attended to, overhaul all farming implements and replace worn parts to ensure efficiency. Shell ground nuts required for the season's planting. Ploughing of old lands should, at latest, be finished this month. If seed potatoes will not keep in good condition until next month, they may be planted now, but later planting is better. Edible canna may be planted this month before rain falls. Also velvet beans, dolichos beans and sunn hemp towards the end of the month for green manuring. Harvest winter cereals and plough under the stubbles as soon as possible after harvest. When rains have fallen, use every effort to improve the tilth of the lands which will be the first to be planted. On cloddy lands already ploughed, seize the opportunity to break down the clods by disc and drag harrowing as showers of rain fall. A spiked roller is very useful for this work. A good tilth means good planting, and a good stand of maize; therefore, do everything possible by cross ploughing, disc and drag harrowing to bring the soil into good condition for seeding.

When necessary, keep the harrows going to check early weed growth. Clean lands at this time of year are an insurance against cutworm and other insect pests. If weather conditions permit, plant a trap crop of maize to attract the stalk borer. New land to be ploughed and intended for planting this season should be cleared of heavy grass or weeds by burning or cutting to ensure good work being done by the ploughs. Seasonal showers of rain are liable to spoil bricks unburned. See that bricks which have been made are protected from rain. Clean out guttering

and down-spouts of house and farm buildings. Press on with development work so as to have this completed before rains break.

DAIRYING.

During the month of October and until such time as the rains have commenced and green grazing is available, dairy stock require to be almost entirely stall fed. Cows in milk and cows due to calve should be liberally fed on succulents and concentrates in order that they may commence the dairying season in good condition, and make full use of the early grazing for milk production. Dairy cows that are underfed at this time of the year invariably produce milk of poor quality, and usually throw weedy undersized calves; furthermore, they do not pick up in condition until comparatively late in the season.

During October, the cow's ration should consist of succulents such as silage or green feed, etc., legume hay of good quality and a liberal allowance of concentrates; a pound or so of a feed such as ground-nut cake is invaluable for dairy stock at this time of the year.

Weather conditions are generally fairly warm during the month of October, and every precaution should be taken to keep the cream, which is used for butter-making or which is sent to the creamery, as cool as possible. The can or bucket containing the cream should be placed in a basin of water or concrete trough, in the dairy, and exposed to a draught; a piece of kaffir blanket, which dips into the water, should be wrapped around the can or bucket containing the cream. Churning of cream for butter-making is best carried out early in the morning—before sunrise if possible; the coolest water obtainable should be used for washing the butter whilst in the granular stage.

At this season of the year cheese-makers may find that the milk is deficient in butter fat; this is generally the result of under-feeding or unsuitable feeding. Cheese made from milk of low fat content is invariably dry and hard, defects that are accentuated by over cooking the curd or by cooking at too high a temperature. The curd should be firmed in the whey at a temperature not higher than 98° F. to 100° F.

DECIDUOUS FRUITS.

Keep all trees well watered until the rains commence; cultivate after each watering to prevent evaporation of added moisture. Rub off all undesirable shoots, such as those arising on the main stem near the ground; also those shoots having a tendency to crowd each other. Two or more shoots should not be allowed to develop from the same spot on any part of the tree. Rub off the weaker ones soon after they appear. The fruit of early peach trees should be thinned out if a heavy crop has set; this thinning will result in a crop of large-sized fruit. All fruit should be thinned out if necessary.

ENTOMOLOGICAL.

Maize.—Where circumstances permit early growth of maize, crops planted late in October are liable to suffer in December from stalk-borer, especially if only a few acres are involved. If maize can be planted early in October, the plants are usually large enough by December to outgrow serious damage. Maize beetle is now in its pupal stage. Thorough working and smashing up of the soil at this time will destroy great numbers.

Tobacco.—See notes for last month, together with article in the "Rhodesia Agricultural Journal" for October, 1926, on "Baiting of Tobacco Seed Beds with Cyanogas Calcium Cyanide." The lands must be kept free from all weeds which caterpillars may feed on, and it is well not to have maize, tomato and Cape gooseberries near the lands; a clearing of some depth is advisable, which must be regularly weeded. If poisoned bait is put down, it has been found that a covering of sacking or leaves will help to retain moisture and thus give further attraction,

especially at this time of the year. In order to lessen the heavy infestation of caterpillars and other insect pests in the seed beds, coverings of hessian or cheese cloth should be kept over beds, especially at night; cutworm moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night. Notwithstanding precautions in the covering of the beds, insects will enter, and after the emergence of the seedlings a weekly spraying should be carried out. Lead arsenate at the rate of 1½ ozs. (powder) or 3 ozs. (paste) in a 4-gallon petrol tin can be sprayed on the plants once a week to keep insect pests in check. Lead arsenate can be safely used with Bordeaux mixture, the constituents not reacting upon one another. The two combined sprays act as a preventative and deterrent to insect and fungoid troubles.

Cotton.—Thorough cultivation and keeping down of weeds should be resorted to in order to lessen the infestation of over-wintering pupæ, by exposure to the sun, and birds.

Potato.—Avoid introducing root gallworm and potato diseases to valuable land under irrigation or to the home garden with seed potatoes. Growing plants in October may be defoliated by caterpillars, or the tops severely injured by the potato tuber moth. Spray with arsenate of lead (powder), 1 lb. to 30 gallons of water; or (paste), 1 lb. to 16 gallons of water.

Cabbage, Turnip, etc., are apt to suffer severely from diamond back moth and webworm. Dust regularly with Paris green, 1 lb.; fresh water-slaked lime, 20 lbs. For cabbage aphis, water liberally, and wash plants regularly with a forceful stream of water from a hose or spray pump.

Beans and Peas are little attacked by insects at this time of year. If aphis (green fly) is troublesome, the plants may be sprayed with soap wash or tobacco wash. Leaf-eating beetles are best destroyed by hand.

Cucumbers, Marrows, etc., may be attacked by leaf-eating beetles, which quickly destroy the young plants. The young plants may be protected by gauze covers. Once vigorous growth has started, the damage is negligible.

Citrus.—All out-of-season fruit should be removed by this time. Destroy all fruit "struck" by the false codling moth. Aphis may be controlled by very careful spraying with the combined "Lime-Sulphur-Nicotine" spray (for details see "Rhodesia Agricultural Journal," Sept., 1926, page 871), while the yellow thrip may also be kept in check by this spray. Avoid using miscible oils for citrus spraying. A careful search should be made for the American bollworm ("Heliothis obsoleta").

Deciduous Fruit Trees, including grape vines, are liable to attack by chafer beetles. Heavy spraying with lead arsenate (paste), 1 lb. to 10 gallons of water, or (powder), 1 lb. to 20 gallons, appears to afford considerable protection, but the leaves need thoroughly coating.

Fig.—Fruit infested with fig weevil should be collected regularly and destroyed.

FLOWER GARDEN.

All flower seeds, annual and perennial, may be sown as in September. A word or two on open seed beds may not be out of place here. These beds should be prepared in a sheltered position, and the soil should be well and deeply dug. This is most essential, as in this state the soil when once watered is more easily kept moist, and is not so liable to cake. The top dressing should be free from all undecayed vegetable matter, and when sown, the seeds should be covered with a thin dressing of fine light soil, over which a thin covering of grass may be placed to check evaporation. Transplanting from boxes or beds should be done on a dull day or towards evening; the plants should be well watered before being removed, and the roots disturbed as little as possible, care being taken that the latter have their full depth and spread when planting.

VEGETABLE GARDEN.

As in September, nearly all vegetable seeds may be sown. Early potatoes should be earthed up when reaching the height of about eight inches. In planting a small amount of marrow, melon, cucumber, and pumpkin, the writer has found it economical to sow the seed one in a tin and transplant when about four inches high in hills. A few cucumbers planted in this manner yielded nearly 400 a week for about two months. Sweet corn and maize may also be sown this month.

FORESTRY.

The main sowings of Eucalypt (gum) seed should be made either in seed trays or in well prepared seed beds. A well-broken soil forming a fine tilth in the seed bed ensures more successful germination and better plants. If transplants are being used, any seedlings which are ready should be pricked out.

Seedlings in open beds may have their tap roots cut so as to develop fibrous lateral roots, and thus produce good type stocky plants. Remember the plant feeds through its roots, hence the better the root system, the healthier the plant and the greater its chances of successful establishment. If conditions are favourable, cross-plough and harrow land for planting broken up in early autumn.

POULTRY.

October is usually a hot month, and poultry keepers should therefore see that their birds have access to shade during the day. At the same time they should have plenty of air. One often sees birds during hot weather sitting under dense bushes, which is almost worse than no shade at all.

All houses should be examined and, if necessary, repaired. It is advisable to repeat the caution that birds must have dry quarters.

Many poultry keepers do not realise the vital necessity of giving their birds especially the young stock, plenty of succulent green food during the hot weather. It should be cut up and placed in boxes or hoppers about 7.30 a.m. and 5 p.m., and, if very hot, also at noon; it should never be placed in the sun. As much as the birds will eat should be supplied. Lack of it, especially during hot weather, causes a reduced output of eggs, smaller eggs and light-coloured yolks; further, a disease known as "nutritional disease" is likely to affect the birds and cause deaths. The symptoms are much like those of eye roup, without the well-known offensive smell of roup. It is due to the fact that vitamine A, which is present in large amounts in all succulent green foods, and which is so necessary for nutrition, is lacking. There is no doubt that many chickens and fowls die each year from this cause.

Ducks.—These during the hot weather require even more shade than do fowls; they cannot stand the direct rays of the sun nor sultry heat. The houses should always have dry floors, and should be overhauled before the rains commence. Ducks sleeping on damp floors often contract rheumatism and cramp. The floor of the duck house should be raised a few inches, thus ensuring a dry bed.

As many ducklings should be hatched as possible now, provided, of course, there is the prospect of a sale for them at ten weeks old. They thrive best in the wet weather.

Turkeys.—Stop hatching until after the wet season is over. To rear turkeys in the wet weather entails a good deal of time, labour, expense and often losses. Once a young turkey chick gets wet, it will probably die; at any rate it will never be the same bird it would have been had it not got wet. Give the older turkeys all the range possible; the further afield they go, the better grown birds they become, and less is the expense of feeding. See also that their roosting quarters are water-tight before the rains commence.

STOCK.

Cattle.—Ranching cattle on granite veld will in many instances be in fairly good condition on account of the early grass in the vleis, etc. On the diorite soils and later veld the cattle owner will still have to watch his weaker cattle carefully. In any case all supplies of hay, ensilage, majordas, etc., should be carefully husbanded in anticipation of possible late rains, but at the same time every effort should be made to prevent cattle becoming weak. Dairymen will need to feed highly both with succulents and green foods. Calves should be weaned and branded if this has not already been done, and care should be taken that they do not suffer any serious setback by reason of want of feed. The question of a mineral mixture should receive consideration.

Sheep.—If spring lambs are expected, one should see that the sheep-shed is in order, and that there is a supply of hay, ensilage or mealies for the poorer ewes in the event of late rains. All drinking places should be cleaned out, and care taken that the water supply is sufficient. Ewes for winter lambing should be well looked after, so as to get them up in condition before they are put to the ram next month. General shearing may start, including the April-May lambs.

TOBACCO.

Continue to sow seed beds. Where grass has been put on the seed beds to assist germination of seed a daily inspection should be made, and as soon as the first few plants make their appearance the grass should be raised up a little from the bed in order to prevent the plants growing "spindley." All possible preparation for the coming planting season should be made.

VETERINARY.

White scour is prevalent in spring—November and December—but dipping is eradicating this disease. There is still danger from vegetable poisoning, and it will only disappear when there is plenty of good grass on the veld.

WEATHER.

This is apt to be a hot, dry month, and rather trying, therefore, to man and beast, and the strong winds which blow at this season add to the general discomfort. Evaporation is, as a consequence, at its greatest at this time of year, and dams and pools lose most from this cause. The prevalence of veld fires at this time of year adds to the anxiety of the stock owner.

The rainy season has occasionally started early in October, but for practical purposes it need not be expected before the end of this month. The days are becoming warmer, and often even hot and oppressive. Clouds gradually collect, at first disappearing at sunset, but later becoming more persistent. Sheet lightning is usually frequent, and showers of gradually increasing severity mark that the rainy season has set in. Steps should be taken in advance to provide for the run-off after such torrential rains, otherwise serious loss may result.

The normal rainfall varies from three-quarters of an inch to an inch in the different portions of the country. The rain usually occurs in the form of thunder-showers, which are not long sustained and are fairly local, but the total rainfall experienced during the month does not vary much over the whole country, with the exception of the eastern border, where the rainfall is usually heavier.

November.

BEE-KEEPING.

Now that the first honey flow is on, be sure the hives stand level, whether working them for extracted or section honey. This is important, saving annoyance when preparing the product for market. Occasionally, where bees have not been thoroughly subdued, they object to the removal of honey; postpone the operation for 24 hours. Where increase of stocks is required, artificial swarms can now be made. Use care in storing honey.

CITRUS FRUITS.

If no appreciable rain has fallen, irrigation must be resorted to in order to keep the trees in good growth and to prevent any check to fruit development. This is a good month to plant green crops. Sunn hemp is possibly the best crop to smother weed growth and supply humus-forming material after it is ploughed in. If not already done, storm drains should be made on the sloping ground to prevent erosion of the surface soil during heavy storms. Where new plantings are contemplated, the holes should be dug and everything got in readiness for planting if the trees are ready for lifting in the nurseries. All unthrifty trees could with advantage have an additional amount of fertiliser and manure applied during the month. Keep down all water shoots.

CROPS.

Take note when the first rains fall, and see what leaks there are, if any, in the farm buildings. Do not neglect to effect such repairs as are necessary. Early in the month see that the planters are in perfect order, and that they drop the different seeds to be planted evenly and at the right distance. Try them out on the farm road. Hasten the work of getting the lands for early sown crops into as good a condition for seeding as possible, so that the first and most favourable opportunity for planting may be seized. The young plants make more rapid growth in a good seed bed. Utilise exceptionally early rains for this purpose rather than for planting. The holes for check-row planting of maize can continue to be prepared until sufficient rain has fallen to allow of planting. Velvet beans and dolichos beans for seed or hay may be planted dry if the land is in good order. With favourable weather, planting of maize, velvet and dolichos beans and cotton will commence about the middle of the month, and will continue as the condition of the land and the rainfall permit. Main crop potatoes should be planted from now on to January. Dhal may be planted for seed or green manuring—if for seed, a frost free situation is necessary. Kaffir corn for seed may be planted this month. Green-manure crops requiring a long growing season should be planted. Destroy, by feeding or burning, early planted trap crop of maize or volunteer plants which have become infested with stalk-borer.

If weeds are beginning to show, keep the harrows going in front of the planters. If weeds are too advanced to be killed by drag harrows and too numerous to be dealt with by hand labour, use the disc harrow or lightly re-plough the land. If the tilth is good, do not be afraid to harrow the young maize. This will save much labour later on by destroying the weeds while they are small.

DAIRYING.

In a normal year veld grazing should be plentiful in November, and the feeding of dairy stock is then very much simplified; veld grass in a green and succulent condition is practically all that is required for animals of less than average production. Heavy milking cows, however, on early pasture, require extra feed in the form of concentrates, while the latter should always be fed to dairy stock which are in poor condition

at this time of the year. Young calves should not be turned out to graze with the herd, and in wet weather are best kept in a clean, dry, airy pen. Weaned stock, which have not hitherto had access to green pasture, should be gradually accustomed to the change in diet and may at first be turned out to graze for short periods. Young stock on pasture should also receive a small daily allowance of concentrates.

Farmers supplying cream to the creamery should adjust the cream screw to the separator so that the latter will separate a cream testing 45 to 50 per cent. butter fat. Cream of this consistency will keep better than thinner cream. It should be borne in mind that it is practically impossible to produce first-grade cream if the cattle are milked in a muddy kraal. In the absence of a cow shed, every endeavour should be made to erect a small milking shed in which four or five cows can be tied, milked and fed. A small shed of this kind is also essential to obtain clean milk for cheese-making. Milking in a muddy kraal invariably results in a gassy, bitter cheese being produced.

The shelves of the cheese room should be scrubbed with boiling water and soda, and for the last rinsing a weak solution of formalin may be used. This should prove effective in controlling cheese pests.

DECIDUOUS FRUITS.

Continue thinning out fruit on the trees if a very heavy setting has occurred. A small amount of large-sized fruit is preferable to a large crop of small fruit. Thin down the inner growth of new shoots if they have a tendency to crowd each other, and stop all suckers and main stem growths as they appear.

ENTOMOLOGICAL.

Maize.—Crops planted before the last week in this month are liable to suffer later from stalk borer. At Salisbury, crops planted after 27th November have escaped serious injury, but early December plantings are probably the safest. Volunteer maize is commonly badly infested and should be cut out and removed immediately, otherwise the borers tend to spread to surrounding plants. If rain has fallen sufficiently early, lands may be baited at the end of the month against surface beetles, snout beetles and other pests which tend to reduce the primary stand of plants. The formula is arsenite of soda 1 lb., cheapest sugar 8 lbs., or molasses 1 gallon, water 10 gallons. Dip chopped Napier fodder or other green stuff and distribute broadcast. The poison may be sprayed over volunteer maize and weeds on land with good effect. Cutworms do not usually appear in numbers until December, except in low-lying land. Succulent green stuff soaked in a 2 per cent. solution of sodium fluoride is the most recent formula for poisoned bait, but destruction of these pests is difficult. Keep the land clear of weeds as a preventive measure. If the young plants are attacked by the black maize beetle (heteronychus), the only remedy is to destroy by hand. Good, clean farming will control these pests to a large extent.

Tobacco.—This crop is subject to many pests in its early stages, although attacked by a few after vigorous growth has started. Keep cheese cloth covers on seed beds at night to exclude pests, and spray regularly with arsenate of lead (powder) 1 lb. in 30 gallons of water to protect against leaf-eating insects, etc. Lands may be baited against surface beetles with maize bran moistened with arsenate of soda 1 lb. in 30 gallons of water. Distribute in balls about the size of a golf ball and cover over with branches or anything to protect from sun. Place one ball to each ten plants and moisten again when dry.

Potato.—The first brood of leaf-eating ladybirds appear in November. Spray with arsenate of lead (powder) 1 lb. in 30 gallons of water. Spraying is also useful against the black blister beetles, which sometimes attack the crop on sandy soils. Keep the soil of irrigated crops well hilled and in friable condition as a precaution against tuber moth laying eggs on the tubers.

Kitchen Garden.—Plants of the cabbage family are liable to attack by diamond-back moth and other leaf-eating insects. When considered desirable, young plants may be dusted lightly with arsenate of lead (powder). Cabbage aphis may be kept in check by liberal watering and frequent washing with a forceful stream of water from a hose pipe or spray pump. Drenching the plants regularly with cold water is also held to be a good remedy for the diamond-back moth mentioned above.

Deciduous Fruits.—Young trees may need spraying with arsenate of lead (powder) 1 lb. in 20 gallons of water as a protection against chafer beetles, whose attack may check the growth very seriously. Choice varieties of early peaches may be netted to protect them from fruit-piercing moths.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

All seeds may now be planted. Annuals for January flowering should be sown, amongst which the following will be found to do excellently in this Colony:—Balsam, Calliopsis, Centurias, Chrysanthemum, Dianthus, Escholtzia, Marigold, Mignonette, Gallardia, Phlox, Poppy, Nasturtium, Nigella, Verbena and Zinnia. These are all hardy, and may be sown in the open either in beds or in the position desired for flowering. Advantage should be taken of each shower of rain during this month to keep the soil well worked and loose.

VEGETABLE GARDEN.

All vegetable seeds may be sown during this month. Tomatoes and early peas and beans should be staked. The soil should be kept loose and free from weeds, which now get troublesome. Sow pumpkin, mealies, peas and potatoes.

FORESTRY.

Sowings of eucalypt (gum) seed should be made for late planting. If fresh seed of cedrela toona is available, sowings should be made. Keep the seed beds moist and free from weeds. The tap roots of early seedlings may be cut back in order to form hardy, stocky plants most suited for planting. Continue with pricking out if transplants are to be used.. Prepare all land to be planted by cross-ploughing and harrowing. A well prepared soil is a good fertiliser; it assists establishment and reduces failures.

POULTRY.

Some birds will now be commencing to moult. This will cause a decrease in the number of eggs laid. The poultry keeper, therefore, should see that his birds come through the moult as quickly as possible. Some birds will lay and moult simultaneously, but these are the strongest, most vigorous and the best layers; the majority do not. The process of moulting is a natural one, but it is a severe strain on the system. Fowls that are not too fat, and can stand extra feed at the commencement of the moult, come through it best. More green and animal food should be given, and the utmost care taken that they are not exposed to cold or wet, otherwise they will not only take longer to moult, but go off in condition. A little linseed stewed, or linseed meal, or ground nut meal and milk should also be given. There will next month be a demand for table birds, and such as the poultry keeper intends to sell should be selected. In making this selection, it is no use choosing old or scraggy birds, for it is hopeless to attempt to fatten these, or make them good table birds. Do not coop them up till a fortnight or so before they are to be sold; give them free range and feed them well, with at least one feed of soft food mixed with milk once a day.

Turkeys destined for the Christmas market should have free range, but also a feed of soft food once a day, and a good feed of mealies in the evening.

STOCK.

Cattle.—Normally rains should have fallen and the veld should be plentiful now. Beyond careful dipping, ranchers should not have much worry. If the season is bad, the poorer cattle should be drafted out and given a little hay, ensilage or maize daily. The grazing should be improving rapidly in feeding value. If normal rains have fallen, the grass should be sufficient for cows of average production. Heavier milkers should be fed concentrates at the rate of about 3 lbs. per gallon of milk produced over the first. In most cases maize meal alone will be sufficient for the purpose.

Sheep.—Dip sheep; put the rams to the ewes; keep the sheep on high dry land; be sure the kraal or sheep shed is dry and clean, and that there is shelter from the rain for young lambs.

TOBACCO.

Continue to sow seed beds, watering, etc. When early beds become overgrown and hard, pull out, dig up and re-sow. Begin transplanting with the first good rains, and continue as fast as the rains and planters will allow, until the crop is set out. Be careful to fill in the misses from previous transplanting before starting on new fields; use the stoutest and best plants for filling in, and try to get the tobacco from any one field to grow and come to maturity as near at the same time as possible. Discontinue filling in when the field has been planted for several weeks and has made a good start to grow, as the later filled in plants will be choked out by the earlier ones, and will not come to maturity. Cultivate fields as soon as plants are established, to keep down weeds.

VETERINARY.

Early heavy rains might bring on horse-sickness before its usual time, but as a rule it need not be feared till the first rains are over in December.

WEATHER.

The rains should be commencing, if not already begun; occasionally they have delayed until December, and even later, before setting in properly. Between spells of wet weather lasting several days, fine dry periods occur, at first clear, but later cloudy and thundery, gradually gathering to burst in thunderstorms. The mornings are generally fine, and rain falls chiefly in the afternoon or evening. Heavy downpours are to be expected, and should be provided against beforehand by means of ditches and embankments, and by clearing water ways and furrows. In a normal season the rainfall varies from two-and-a-half to three inches in Matabeleland, and from three-and-a-half to four inches in Mashonaland generally, with the exception of the eastern border, where it amounts to five inches. Between the rain periods and prior to the commencement of the rains, severe heat is likely to be experienced.

SOUTHERN RHODESIA VETERINARY REPORT.

July, 1932.

AFRICAN COAST FEVER.

Melsetter District.

Rocklands Estate.—The process of removing the infected herds through temperature camps was continued. The mortality from coast fever during the month was 113 head.

Laughing Waters.—The infected herd was moved to a further temperature camp on clean veld. Mortality during the month, three head.

Orange Grove.—The temperaturing of the infected herd, which was removed to Welgelegen, was completed. No cases of coast fever occurred.

No fresh developments at the other infected centres.

FOOT AND MOUTH DISEASE.

Gwelo Veterinary District.

Three fresh outbreaks occurred, viz.: (1) On West Gwelo Block adjoining the previously infected Aberfoyle Block; (2) on farm De Rust adjoining the infected farm Pender; and (3) on farm Sonambula No. 2, west of the railway line. Concentration of infected and adjoining herds was carried out where possible, and all cattle involved were inoculated.

Umvuma Veterinary District.

No fresh outbreaks. The inoculation of the Central Estates cattle, over 31,000 head, was completed on 29th July.

Victoria Veterinary District.

This area is now regarded as free from disease.

Bulawayo Veterinary District.

Insiza District.—Infection was found amongst some herds in the Mbondu dipping tank area adjoining the infected

Siwazi area. All the cattle directly and indirectly involved—upwards of 8,000 head—were concentrated for inoculation, leaving a cattle free belt of ten miles wide on the northern side. On the western side cattle free belts and strong cordons have been established and to the east all cattle have passed through the disease. Inoculation was completed on the 28th July.

No further infection occurred in the Virgina area and the inoculated cattle were returned to their respective kraals.

Gwanda District.—Infection extended from the Donkerhoek inoculation camp to the farm Sherborne, a sub-division of the eastern section of Olympus Block. This area lies immediately to the south of the infected areas in Insiza district. In order to prevent the spread of infection a cattle free belt of five miles was established on the western bank of the Umzingwane River by moving the cattle thereon to the eastern section of Olympus, and by moving all cattle south of Olympus Block to a point five miles further south. This effects a cattle free belt west of the Umzingwane River five miles wide from the south-western beacon of Glass Block to a point five miles south of Olympus Block. All cattle involved in this outbreak were inoculated.

TRYPANOSOMIASIS.

Mortality from this disease occurred on four farms on the Eastern Border, Melsetter district, and also on several farms in the Darwin district.

HORSESICKNESS.

One case in the Melsetter district and one at Inyati.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate: Bulls 3, heifers 30, oxen 51, cows and calves 319, horses 30, donkeys 7, sheep 1,033, goats 194.

EXPORTATIONS.

Nil.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA WEATHER BUREAU.

AUGUST, 1932.

Pressure.—Mean barometric pressure for the month was well above normal except at Salisbury.

The usual winter anticyclone was established in the Transvaal from the 1st to the 8th; gradients were weak on the 9th and 10th and on the 11th, and a low appeared off the S.W. Cape and remained until the 14th, when a fast-moving high approached the W. coast. The high became established in the Transvaal on the 16th and 17th, but later extended up the coast to the north of Madagascar, and a second low appeared on the south coast. Surface winds were south-easterly and cold, but a strong northerly persisted in the upper air, and very unusual rains occurred in the north.

Temperature.—Mean monthly temperatures were generally below normal.

Rainfall.—Rain fell between the 18th and 21st in the north and west and at a number of stations the previous maximum for August was exceeded. Light showers of the guti type were recorded later in the month in the south and east.

AUGUST, 1932.

Station.	Pressure Millibars, 8.30 a.m. Mean.	Pressure Millibars, 8.30 a.m. Normal.	Temperature in Stevenson Screen ° F. Absolute. Max.	Absolute. Min.	Mean. Max.	Mean. Min.	Mean. ½ Max. Min.	Mean. Normal.	Mean. Dry Bulb.	Mean. Wet Bulb.	Rel. Hum. %	Dew Point F.	Cloud Amt. 0-10	Precipitation. Ins.	Precipitation. Normal.	Precipitation. No. of Days.	Altitude (Feet).
Bulawayo ...	873.5	872.5	81	36	71.3	44.8	58.1	60.8	58.9	48.9	47	39	1.5	...	...	...	4,436
Gwelo	867.1	...	80	36	71.2	44.2	57.7	59.6	57.4	49.1	54	41	2.2	0.01	...	1	4,632
Riverbank ...	...	...	86	39	76.5	46.5	61.5	62.4	58.8	49.2	49	40	...	...	...	...	4,100
Essexvale ...	...	...	90	33	77.7	41.2	59.5	60.7	51.5	46.6	69	42	..	...	...	...	3,828
Gwanda ...	912.4	...	85	34	75.1	44.4	59.8	...	60.5	51.0	51	42	1.5	...	0.1	...	3,235
Mazunga ...	954.8	953.1	91	37	79.9	44.5	62.2	64.3	63.0	55.2	61	49	2.4	...	0.2	...	1,970
Nuanetsi ...	...	...	90	37	79.8	45.2	62 5	...	60.0	53.6	66	48	2.1	0.20	...	1	1,630
Between Rivers	...	...	85	33	76.6	42.2	59.4	...	57.2	50.2	61	44	0.9	0.70	0.1	2	3,970
Enkeldoorn ...	...	...	80	36	69.5	44.5	57.0	59.9	58.4	50.7	57	42	2.2	0.05	...	1	4,720
Gatooma ...	...	...	85	37	76.7	44.3	60.5	63.3	60.5	51.5	53	43	1.0	0.06	...	3	3,850
Miami	883.3	...	81	40	73 6	47.0	60.3	...	60.2	52.2	58	46	0.8	0.55	...	2	4,090
Salisbury ...	859.0	859.0	78	38	70.5	45.2	57.9	59.6	58.3	49.5	53	42	1.8	1.78	...	4	4,890
Sinoia, Citrus ...	...	...	85	36	76.5	42.8	59.7	..	58.3	50.8	59	44	0.6	0.48	...	3	3,800
Sipolilo... ...	...	...	80	40	72.9	49.0	61.0	...	60.9	51.8	53	44	1.3	0.64	...	1	3,900
Mtoko	...	...	80	41	70.9	48.2	59 6	...	58.3	51.4	62	46	1.3	0.18	0.1	1	4,210
Shamva ...	...	...	85	37	77.7	45.8	61.8	...	59.2	...	...	...	1.2	0.17	...	2	3,170
Angus Ranch ...	...	...	87	44	77.8	51.3	64.6	64.2	60.7	54.2	66	49	...	0.08	...	2	2,300
Craigendoran ...	...	...	88	36	78.5	48.1	63.3	...	65.2	56.0	56	49	...	0.03	0.1	1	3,430
New Year's Gift	...	...	86	46	75.9	50.9	63.4	...	59.8	53.5	66	48	...	0.09	0.1	2	2,700
Nyamasanga ...	...	...	76	35	68.0	42.7	55.4	...	57.8	50.4	59	44	...	0.17	...	4	5,080
Riverdene North	...	...	84	31	74.4	38.6	56.5	...	50.8	46.7	74	43	...	0.04	0.1	2	3,700
Stapleford ...	...	...	71	30	61.0	40.5	50 8	...	53.3	48.2	69	43	3.3	1.13	0.1	7	5,450
Umtali	898.2	897.5	82	40	71.5	47.9	59.7	61.4	61.1	53.5	61	48	3.2	0.20	0.2	4	3,677
Victoria ...	...	...	83	35	72.6	42.3	57.5	58.6	57.9	49.6	55	42	2.0	0.02	0.1	1	3.570
Melsetter ...	854.8	...	77	39	66.7	46.3	56.5	...	58.5	49.3	51	41	2.2	0.35	0.4	2	5,060
Mount Selinda	...	...	80	44	70.7	49.0	59.9	...	58.9	52.7	66	48	2.9	0.56	0.7	5	3,520
Manchester ...	...	...	75	37	63.4	43.2	53.3	...	47.3	45.3	86	44	...	0.47	...	4	...

SALES.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

Spineless Cactus Slabs (blades) Algerian variety, per 100 slabs, 7/6 Salisbury, or 12/6 delivered free by rail to purchaser's nearest station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Stocks are limited and delivery cannot be undertaken after 15th November.

Kudzu Vine Crowns, per 100 crowns, 15/-, Salisbury, or 25 crowns, 7/6; 50 crowns, 15/- and 100 crowns, 22/6, delivered free to purchaser's nearest station or siding in Southern Rhodesia. Delivery during September and October for irrigated land, and in January for dry land. Owing to pressure of other operations, it is not possible to deliver Kudzu crowns during November and December.

Woolley Finger Grass: 10s. per bag of roots, delivered on rail nearest station or siding; supplies limited. Available January and February.

The prices quoted above do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

DEPARTMENTAL BULLETINS.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.

No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.

No. 429. Propagation of Kudzu Vine, by H. C. Arnold.

No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.

No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.

No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.

No. 550. Onion Growing under Irrigation, by C. Mainwaring.

No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.

No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.

No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.

No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.

No. 630. The Storage of Seed Potatoes, by H. C. Arnold.

No. 634. Barley, by P. V. Samuels.

No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.

No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.

No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.

No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.

No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold

No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.

No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.

No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.

No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.

No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.

No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

No. 759. Witch Weed (Striga Lutea): Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.

No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.

No. 781. Agricultural Costings at the Gwebi Farm—Maize and Green Manuring, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

No. 787. Agricultural Costings at the Gwebi Farm—Ground Nuts and Maize and Beans for Silage, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 793. Agricultural Costings on the Gwebi Farm, by H. G. Mundy, Dip.Agric., Chief Agriculturist.

No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.

No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.

No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.

No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.

No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.

No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.

No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.

No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.

No. 833. Subterreanean Clover on the Sand Veld as Feed for Poultry in the Winter, by S. D. Timson, M.C., Dip. Agric. (Wye).
No. 836. The Potato, by S. D. Timson, M.C., Dip. Agric. (Wye).
No. 837. Veld Grass Silage—A Feature in Rhodesian Pasture Management, by H. G. Mundy, Dip. Agric. (Wye), F.L.S., Chief, Division of Plant Industry.
No. 838. Witch Weed—Progress Report and a Warning, by S. D. Timson, M.C., Dip. Agric. (Wye), Assistant Agriculturist.
No. 841. Poisonous or Suspected Poisonous Plants of Southern Rhodesia: Tulp Poisoning of Cattle, by Sydney M. Stent, Senior Botanist, and D. A. Lawrence, B.V.Sc., Veterinary Research Officer.
No. 855. Pigeon-hole Method of Stacking Maize, by Division of Plant Industry.
No. 859. Twenty-one Years of Plant Introduction, by Major Mundy, Chief, Division of Plant Industry.

REPORTS ON CROP EXPERIMENTS.

No. 608. Annual Report of Experiments, 1924-25, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip. Agric., F.L.S.
No. 631. Bulawayo Experiment Station: Annual Report for Year 1925-26, by H. W. Hilliard.
No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.
No. 675. Bulawayo Experiment Station—Annual Report for Year 1926-27, by D. E. McLoughlin.
No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.
No. 688. Report, 1923-24—1926-27, Gwelo Municipal Demonstration Stations, by D. E. McLoughlin.
No. 716. Report, 1927-28, Gwelo Municipality Demonstration Stations, by S. D. Timson, M.C., Dip. Agric.
No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.
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EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Transit of Chilled or Frozen Meat through the Union.—For more than eighteen months now the transit of chilled or frozen meat through the Union has been prohibited. Owing to the improved position, however, this matter was discussed with Col. G. N. Williams, D.S.O., Union Secretary for Agriculture, during his recent visit to Salisbury, with the result that the following conditions were drawn up and submitted to the Union Government for their approval and acceptance.

Notification has now been received that they have been approved, and it is anticipated that they will be in force by 1st November, 1932.

1. That the meat be drawn from cattle in areas not less than 25 miles from any foot and mouth disease. The cattle to be inspected by a veterinary officer prior to leaving the farm and to be further inspected on arrival at the abattoir

in Bulawayo, and the carcases to be again inspected by a veterinary officer prior to despatch from Bulawayo. The consignments to be accompanied by a certificate to the effect that these inspections have been carried out, that the animals and carcases showed no symptoms of foot and mouth disease and that subsequent to the inspection on the farm they have not been driven through any infected area or brought into contact with any infected animals.

2. Meat must be consigned in through trucks from Rhodesia to the docks.

3. The handling at the docks to be entirely separate from that of any Union meat which might be shipped by the same boat.

Handling in this instance means unloading of trucks, on skids and in stowage.

The unloading, handling and stowing of the meat shall be carried out under the supervision of a Government veterinary officer, subject to such precautions as to the disinfection of clothing and the persons of handling gangs as are necessary.

4. Marks on wrappers to indicate clearly the origin of the meat.

5. Provision to be made for marking and return of trucks used for the conveyance of the meat, and for their disinfection before being used for any other purpose, disinfection when carried out to be under veterinary supervision and direction.

6. In the case of frozen meat, which it may not be possible to move straight from the trucks into the ships, and which it may be necessary therefore to put into cold storage, provision shall be made for such storage to be carried out in separate chambers to those used for Union meat and for their disinfection under veterinary supervision and direction before being used for any other purposes.

Locust Position as at 15th October, 1932.—It is estimated that from twenty to thirty flying swarms of locusts are at present in the Colony, and they are, as a general rule, maintaining a westerly to south-westerly direction of flight.

Comparatively little damage has been reported, and they appear to feed generally on the young growth of grass in the vleis.

No reports of egg-laying have been received, and an examination of the insects themselves indicates that they will not be in a condition for egg-laying for some time to come.

There appears to be only the one species concerned, namely, the tropical migratory locust (*Locusta migratorioides*).

Some swarms have traversed the whole breadth of the Colony from the north-eastern border to the Bechuanaland border, and it is possible that some swarms may have already crossed into Bechuanaland territory.

Special Warning to Tobacco Growers.—The attention of all tobacco growers is again directed to an article in this issue by Mr. M. C. Mossop, and also to the report on Leaf Curl in Tobacco in Southern Rhodesia by Dr. H. H. Storey, which appeared in the March number. In the latter it was pointed out that the most important control measure for this disease, which is transmitted by a small species of White Fly, is the thorough cleaning up of all tobacco lands as early as possible after the crop has been reaped, and this aspect of the problem is again stressed by Mr. Mossop.

Notification has now been received from Shamva that a serious state of affairs is developing to tobacco growers in that area, and it is highly probable that a similar condition prevails in other tobacco growing districts.

The second growth of tobacco resulting from the old plants being left in the land after the crop was harvested is now showing infection from Leaf Curl and Mosaic.

The danger of allowing this state of affairs to arise should be perfectly obvious to tobacco growers, and indicates that there is a serious lack of appreciation of the danger which exists.

No tobacco should have been allowed to grow in the field after the tobacco was harvested, and if old lands have

not been thoroughly cleaned, no time should be lost in doing so now.

From the reports which have been received recently, it appears that there are several farms on which tobacco was grown last year and on which it is not intended to grow tobacco during the coming season. In two cases at least it appears that the old plants are still standing on these farms, and it is suggested that even though tobacco is not to be grown the next season, the land should be immediately cleared even if considered from the viewpoint of public interest only.

Owing to the state of affairs which is indicated, it is recommended that special vigilance should be given to seed beds in order that they be preserved from infection, and the utmost care should be taken to avoid transferring infection from the seed bed to the land.

Should the grower be uncertain as to the identity of the White Fly, the Entomological Branch of this Department will be glad to assist if specimens are submitted for identification.

Paper Floors.—During the last few years several enquiries have been received regarding the making of paper floors. We are indebted to a subscriber for the following information, which we are in a position to say gives very satisfactory results.

After measuring up the surface take sufficient old paper to allow two pounds to every square foot of the floor to be covered. Old newspapers are excellent for this purpose. Tear the paper as small as possible, and soak for three or four days in water and then have it stamped in an ordinary mealie stamp until a fine pulp results. Care should be taken that no pieces of the paper remain in the pulp. If this is not possible the old paper may be boiled in a drum with a small quantity of caustic soda. The resulting pulp is then mixed with a thin porridge of mealie meal, or better still, rapoko meal, allowing about ¾ lb. of porridge to every square foot of surface. This mixture is then laid by hand about ½ inch thick over any comparatively smooth, hard floor; concrete floors are particularly suitable. When the whole surface

is covered, the doors and windows should be closed so that the covering may dry evenly. After about two days the surface should be again smeared with the rapoko porridge and then rubbed with a smooth object such as a bottle, smooth stone or iron until the surface is as smooth and even as possible. When the surface is dry it should be rubbed over with boiled linseed oil, after which it can be polished or stained in the ordinary manner. If properly done the floor becomes very hard and shiny, lasts well, and is very pleasant to walk on, being as soft and soundless as cork linoleum. It is advisable, however, to place small wooden rests under heavy furniture such as the legs of beds, tables, piano, etc., and it is further advisable to use small mats near the doors or wherever there is excessive walking.

Rothamsted Experiment Station.—The Report for 1931 of Rothamsted Experiment Station contains the results of many experiments dealing with three problems that are of great importance in the present conditions of agriculture:—

(1) The most efficient use of artificial fertilisers on grass and arable land;

(2) the provision of keep for animals when farm supplies fall short;

(3) the maintenance of soil fertility in regions where mechanisation is advancing and live stock is being reduced.

The experiments on the manuring of grassland have led to some important results. Nitrogenous manuring has increased the growth of grass, but depressed the growth of clover. Phosphates, on the other hand, increase the proportion of clover in the herbage and so add greatly to its protein content. Phosphates, however, differ in their availability to plants and much valuable information on this point, dealing with a variety of soils and weather conditions, is contained in the Report.

The manuring of a fodder mixture differs from that of a single crop on account of the element of competition among the plants themselves. The crops without manure, or with potash or with phosphate only, are rich in protein, and have a high starch equivalent and so make excellent feeds. On the other hand, nitrogenous manures increase the growth

of the cereal component, but reduce that of the vetches and peas. The result is that the total produce per acre is larger, but the feeding value is entirely altered. It does not contain increased protein, but increased starch equivalent and resembles hay of a moderate quality.

The work on legume inoculation has been successfully introduced into farming practice, and search has begun for new strains of organisms even more efficient than the one at present available to farmers.

Mechanisation being usually combined with a reduction in live stock brings forward the problem of maintaining soil fertility.

Four important problems are being investigated at Rothamsted:—

(1) Can fertility be sufficiently maintained by artificial fertilisers or is it necessary to return the straw to the land in the form of manure, and if the straw must be returned what is the best method?

(2) Is it possible to produce, by any cultural process, the same good effects on light land as are obtained by sheep folding?

(3) Effects of green manuring.

(4) Effects of fallowing.

The results so far obtained are contained in the Report.

The laboratory investigations, although highly technical in character, are an essential part of the Rothamsted programme; they provide the scientific knowledge on which improvements in agricultural methods must be based.

Additional rapid methods of testing and classifying soil have been introduced, one of which—the "Pachimeter" test—is also likely to be of use outside the sphere of soil investigations.

The results of researches on the micro-biological activities in soil have been applied with success to the problem of purifying the effluent from sugar beet factories.

Progress has been made in the very difficult problem of virus diseases in plants. The virus has been shown not to travel in the transpiration or water stream; and its entry into

a cell is accompanied by marked increase in the respiration rate.

The Report gives full summaries of 62 scientific papers published during the year and a list of 40 articles dealing with technical aspects of agriculture.

Pig-feeding Experiments.—The first pig-feeding report of the Harper Adams Agricultural College summarises the experiments in pig-feeding carried out between 1926 and 1931. Briefly, these showed that a ration of cereal meals was deficient in proteins and certain minerals for the needs of a rapidly growing pig, but that extracted soya meal, supplemented by lime and salt, gave as good results as fish meal when added to a cereal ration. An average proportion of about eight per cent. of soya meal was found to be adequate, this being best secured by using about twelve per cent. in the ration for a newly weaned pig, and gradually reducing this to a minimum of five per cent. at bacon weights. A mineral allowance of $1\frac{1}{2}$ lbs. limestone and $\frac{1}{2}$ lb. salt per 100 lbs. mixed meals was sufficient, and this seemed to be as effective as the more complex and expensive mixtures containing a great variety of minerals. For sty-fed pigs under normal conditions about 3 lbs. of water per 0.1 lb. meal were needed for young pigs, but this amount could be reduced to $1\frac{3}{4}$ lbs. at bacon weights—a little more being allowed in hot weather. Many factors affect the economic value of milk in pig-feeding, and although whole milk gave a higher rate of gain than separated milk, yet the financial returns were lower than those obtainable by feeding separated milk, in conjunction with butter making or cream selling.—(*Nature*, 24th September, 1932.)

Club Cheese.—Often the housewife has a piece of cheddar cheese that has become too dry to put on the table. This can easily be converted into club cheese, which makes a nice change from the ordinary type and is ideal for sandwiches.

To prepare it, cut off all rind from the cheese, and pass it through the meat mincer. Now mix butter with it in the

proportion of one ounce of butter to eight to ten ounces of cheese. Pass the mixture of butter and cheese through the mincer again, which should free it from all lumps. It is now ready for use.

It can be packed in air-tight glass jars, care being taken not to leave any air-space between the cheese and the glass.

Cheese and butter of good flavour should be used. The stronger the flavour of the cheddar cheese the stronger will be the flavour of the club cheese. More butter is required with a very dry cheese than with a moist one, in order to make the texture soft, but if the cheese is to be kept a long while, too much butter is liable to make it rancid.

Sometimes a little pepper is added, to give the cheese a biting taste.—(Union of South Africa Press Service, October, 1932.)

Commercial Travellers' Samples: Customs Facilities, United Kingdom.—*Importation.*—Articles liable to Customs duty (other than cinematograph films, motor cars, motor car chasses and motor cycles) imported from all parts of the British Empire as commercial travellers' samples or specimens (whether or not accompanied by the commercial traveller) are temporarily admitted without payment of the duty to which the goods are liable, subject to the amount thereof being deposited in cash or secured by bond before their delivery out of official charge.

The traveller or his agent is required to produce a list containing a description, sufficiently full for identification purposes, of the samples or specimens imported, and, in the case of goods liable to duty on an *ad valorem* basis, a statement of their value. The value to be shown in the statement in the price which an importer would give for the goods, if they were delivered, freight and insurance paid (but not duty paid), at the port of importation. It is the price which would be paid on a *bona fide* purchase at the ship's side in this country.

The list (and statement where necessary) should be officially attested by the proper authority in the country of exportation. If, on arrival of the samples or specimens, no

list is available, one may be compiled at the port of importation, in which case documentary evidence of value must be produced for any of the samples or specimens which are liable to duty on an *ad valorem* basis.

Examination of samples or specimens will be limited to ascertaining that they are fully described on the list, and, in the case of goods chargeable on an *ad valorem* basis, that their value is correctly stated.

If the samples and specimens bear the marks, stamps or seals of the country of exportation, no additional marks or seals for purposes of identification will, as a rule, be affixed by officers of Customs and Excise. If the samples or specimens bear no marks, stamps or seals, they may be marked or sealed for future identification.

The list of samples or specimens will be signed and dated by the officer of Customs and Excise, who will affix a statement bearing an official seal or stamp and showing—

(a) the port of importation and the amount of duty chargeable; also whether duty was deposited in money or bond given;

(b) the marks, if any, applied by him to the samples or specimens;

(c) the date on which the duty deposited will be carried to the public account, or recovered under the security given, unless it is proved that the samples or specimens have been previously exported or placed in bond. This date will not be later than twelve months from that upon which the samples or specimens were imported. No charge is made for the document or certificate issued or certified by the officers or for marking for identification.

Re-exportation.—Samples and specimens of dutiable articles imported under these regulations may be produced to the officers of Customs and Excise for examination prior to exportation, and to obtain refund of the deposit on release from the bond given on importation, subject to declaration in respect of any samples or specimens not produced for re-exportation. The list and statement (previously mentioned) must be produced with the goods.

Prior to the re-exportation of goods chargeable to duty on an *ad valorem* basis, a declaration signed in the presence of an officer must be produced with the goods, stating that they have not been used in Great Britain or Northern Ireland for any other purpose than as commercial travellers' samples or specimens, and that they are in all respects identical with the goods imported.

If the samples or specimens of dutiable goods are not re-exported or placed in bond within the prescribed time (not later than twelve months) the duty deposited will be brought to account or the bond put in force.

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

CULTURAL METHODS AND TOBACCO WHITEFLY IN SOUTHERN RHODESIA.

By M. C. Mossop, M.Sc., Entomologist.

About a year ago it first became evident that leaf curl of tobacco might become a problem of primary importance to the tobacco grower. Previously known as "Frenching," it was considered to be of sufficient importance to warrant the destruction of infected plants. During the season 1931-32, however, the disease came into greater prominence, and specimens brought into Salisbury revealed that a species of whitefly (Family *Aleyrodidæ*) was present in fair numbers. Other insects suspected of being vectors of the disease were also present, but Hopkins* has explained how the Plant Pathological and Entomological Branches co-operated to show that the disease was transmitted by the whitefly.

In his article Hopkins also produces evidence that the disease and insect vector were carried over the winter in volunteer plants. In order to confirm this, and to find out to what extent volunteer plants are responsible, a visit was made in September to one of the large tobacco growing areas that had been inspected last season.

On a few farms no effort whatsoever had been made to remove the previous season's plants. On at least one there was no intention of removing them, as the land in question was not to be used this year, although tobacco was to be grown nearby. Whitefly was to be found in small numbers in this land, and the presence of the disease was also evident. In other cases it was the intention to remove the plants and plough the land at an early date.

* Hopkins, J. C. F.: "Further Notes on Leaf Curl of Tobacco in Southern Rhodesia."—*Rhodesia Agricultural Journal*, XXIX., 9, Sept., 1932.

Lands on other farms supported up to more than fifty per cent. re-growth from plants cut off below the soil after last season's crop had been harvested. Both whitefly and leaf curl could be found on such lands. A lower, although distressingly large, percentage of volunteer plants was found on lands where the plants had been pulled up after the preceding season. These plants had grown from portions of roots broken off in the pulling operations. The lands had not been ploughed and the volunteers had attained a sturdy growth. Whitefly and leaf curl were found on these lands.

Tobacco lands that had been ploughed within the previous few weeks were also examined. Whatever method of removing the plants had been adopted, these lands supported at least a small population of volunteer plants, and, young as the plants were, leaf curl could usually be found, although whitefly was frequently not discovered. Small but sturdy plants, some diseased, could be found growing from ploughed-in stalks, and from pieces of root.

Old seed beds, from which most or all of the plants had been pulled, also supported a population of plants on which both the insect and the disease were present. Usually these plants had sprung either from remains of roots or from seeds shed by neglected plants.

In sheltered places, such as against the walls of barns and other buildings, vigorous plants were found, differing from the field volunteers by their breadth of leaf and lack of bedraggled appearance. Some of these harboured whitefly in large numbers and in all stages of development, and leaf curl was also to be found.

In Salisbury observations have shown that the whitefly breeds slowly and in small numbers during the winter months on tobacco plants growing in sheltered places. From August onwards there is a gradual increase in numbers, and by the middle of October the insects are plentiful, though they may still be scarce in the fields at this time.

It has also been noticed that leaf curl can and does persist in a given plant throughout the winter, and that roots of a diseased plant from which the stalks have been cut below ground can give rise to suckers with obvious signs

of the disease in the absence of whitefly. Old diseased plants, however, do not necessarily retain the symptoms, although the plant remains infected and may show the symptoms when it suckers.

In a family of insects that has been rather neglected from the systematic standpoint, it is often difficult for the economic entomologist to distinguish one species from another. This is the case with the whiteflies, and although we recognise two very distinct forms of importance in Salisbury, we may be dealing with several species. It is probable that the insect known as tobacco whitefly is a distinct species, and this is thought to be a species of *Bemisia.*

Plants on which the tobacco whitefly has been found to breed are tobacco, cotton, tomato, *Vernonia* sp., sowthistle (*Sonchus oleraceus*, L.) and pigweed (*Amaranthus graecizans*, L.). On farms it has been found on tobacco, cotton, sowthistle and pigweed. There are almost certainly other host plants of the insect and of the disease. *Ageratum* is suspected of being a host of both.

The common whitefly, another species, which has not been found on tobacco in the field has been reared from egg to adult on tobacco in Salisbury. This has been observed to breed, either in the field or insectary, on at least eight species of plants, including blackjack (*Bidens pilosa*, L.). It is not known whether it can transmit leaf curl disease to tobacco, but as it has not been found breeding on tobacco plants in the field, it would seem of minor importance in this connection. It is parasitised by a species of *Prospaltella* (Family *Aphelinidæ*) which may yet be found to attack the tobacco whitefly.

Tentative recommendations for control have been set forth by Hopkins in his paper already referred to. Our present knowledge of the insect vector and of the disease strengthens the opinion that these recommendations should be carried out. To state the case briefly, cultural practice should be modified as far as possible to ensure the complete eradication of volunteer plants as soon after harvesting as can be accomplished.

To carry out such a plan seems a formidable undertaking, but it can be done. The plants should be pulled out and

burned soon after the crop is harvested. The longer they are left, the harder to pull they become, and the greater is the likelihood of roots being broken and left behind. Pulling should be followed immediately by ploughing. These operations are no more than are normally advised in tobacco culture. But they should be followed by the removal and destruction of stumps and roots by a gang of natives under reliable supervision. Thereafter, it should be the duty of as many natives as circumstances necessitate to go over the lands—say once a fortnight or once a month—and dig up any roots the presence of which may be made evident by their suckers. In many cases one native will be sufficient for this work.

The above practice has been advised for the control of other insect pests and other plant diseases of tobacco. The appearance of an insect pest and a virus disease newly recognised in Rhodesia makes this practice all the more necessary, and the grower who has carried it out in previous years will find no added expense in pest control. If the grower who has neglected it in the past will fall into line, he should find tobacco a more profitable crop. It is obvious that tobacco lands that are to be used for a different crop must receive the same treatment. A clean tobacco land is not sufficient—the neighbourhood also must be clean.

Volunteer plants in and around seed beds and gardens and growing near barns and in similar sheltered places should not be overlooked. Seed beds in use should be covered as usual with tobacco cloth. Although the effect of tobacco extract on whitefly has not yet been demonstrated, it would be advisable, if there is any suspicion of the presence of the insect, to add one part by volume of the 6 to 8 per cent. extract to every 80 parts of Bordeaux Mixture used on the seed beds.

Lastly, weeds must be kept down. Pigweed and sow-thistle are prone to grow in localities prepared for seed beds, and in old seed beds. Other weeds may be hosts of the white-fly and leaf curl and should be suppressed.

WIND-BREAKS AND SHELTER BELTS.

By A. A. Pardy, B.Sc. (Forestry), Forestry Division.

Definition of a Wind-break.—A wind-break is any natural or artificial barrier which effectively checks wind velocity. For example any of the following may form wind-breaks: Hills, walls, trees and hedges.

This article deals with wind-breaks of trees with a few remarks on hedges.

Objects and Advantages of a Wind-break.—The objects of a wind-break are many, the chief of which are:—

1. To reduce evaporation from soils and transpiration from leaves.

2. To shelter an orchard or other crop in order that flowers and fruit may not be blown off and to make conditions more favourable for insect pollination; also to reduce heat and frost damage.

3. To shelter stock from the heat of the day during hot weather and cold winds during the dry season.

4. To provide fuel and timber required on the farm.

5. To prevent erosion of the soil by wind and water.

6. To beautify the homestead.

Disadvantages.—The above advantages may be offset to some extent by certain disadvantages, which include the following:—

1. A certain amount of food and moisture is removed from the soil and may have a deleterious effect on adjacent crops. This effect is not appreciable until wind-breaks have reached some size and are making definite demands on the soil.

Such a disadvantage may be greatly reduced by trenching some distance from the wind-break or utilising the ground along the belts of trees for roads.

2. By improper attention to density the desired effect may not be produced. This may be obviated by a little forethought at the time of planting and devoting attention to the formation and density of the belt.

3. A certain amount of good farm land may be occupied. If this should be an important consideration it must not be overlooked that land carrying a crop of trees is of both direct and indirect benefit to the property.

In summing up it is considered that any disadvantages are far outweighed by the advantages.

The Action of Wind-breaks.—When forming a wind-break its functions and actions should be borne in mind.

A wind-break is essentially for checking a wind. It should, however, not entirely restrict wind penetration or the advantage may be greatly reduced.

If a wind-break is insufficiently dense, too much wind is allowed to pass through it. On the other hand if the wind break is too dense the wind strikes and is turned over it with considerable force on to the protected area some distance from the break, whilst the air adjacent and to the leeward side of the break remains stagnant.

If the correct density is obtained then a certain amount of wind is allowed to percolate through the belt and the desired effect is produced. The percolating wind acts as a cushion for diverting the wind which comes down from over the break. In addition, this gentle current of air prevents any stagnation of the atmosphere.

The sheltering effects of a wind-break are felt for two to five times its height on the windward side and from ten to twenty times on the leeward side. Figure 1 illustrates these points.

If planted with fast growing species a wind-break has an appreciable effect when two to three years old, and by eight to ten years it should be fully effective.

Types of Wind-breaks.—Wind-breaks and shelter belts may be strips or groups of indigenous trees left when stumping new land. The cost of forming and maintaining such wind-breaks should be nil.

Wind-breaks may also be formed of single or multiple rows or groups of exotic trees.

I. *Single Rows.*—These have the advantage of occupying little space and should be used only when economy of space is an important consideration or as an auxiliary belt. They are not recommended as main belts.

If a single row is planted each tree in that row requires to be functioning to the best advantage. If one or two trees in the row are in poor condition, have been killed by fire or thrown by the wind an ineffective wind-break might result. Furthermore, if the belt has been planted with fast-growing species the lower portion of the belt is apt to open out with advancing age and if planted with a slow-growing species it takes some time before the belt becomes effective.

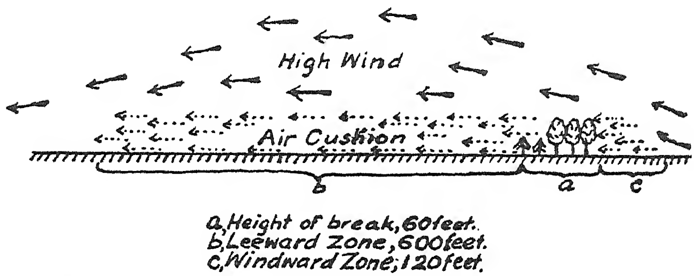


Fig. 1. Zones of effect. Average wind-break of eucalypts and conifers.

Another disadvantage of a single row break is that little latitude is allowed for the removal of certain trees for fuel or timber.

II. *Two Rows.*—When two rows are employed one should be of tall fast-growing trees and the other of slower and more bushy ones. For such a purpose a very suitable combination is to have a row of eucalypts on the windward side and a row of conifers or other slower growing species on the leeward side.

III. *Three Rows.*—By using a wind-break of three rows of trees still greater protection is afforded and there is more scope for the removal of trees for fuel or timber. Such a wind-break could consist of two rows of eucalypts with a row of conifers on the leeward side or one row of eucalypts with two rows of conifers on the leeward side.

Of these two possibilities the former, from the point of view of a wind-break and for fuel and timber production at an early date, is preferable.

IV. *More than Three Rows.*—A wind-break of more than three rows in addition to being used for shelter can, by regulated cuttings, be used for the production of timber and fuel. Such a belt may consist of one or more rows of eucalypts and one or more rows of conifers or other slow-growing species. *Vide* photographs, figures 3 and 4.

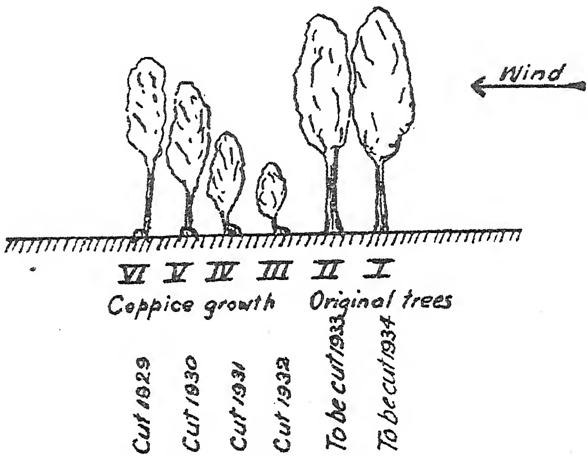


Fig. 2. To illustrate coppicing in six-row eucalypt wind-break, planted 1924.

A method of managing a eucalypt break for the dual purpose of protection and provision of timber is illustrated in Figure 2. Six rows of eucalypts were planted at the end of 1924, and five years later row No. VI. was felled, a year later row No. V. and a year later the row represented by tree No. IV. was felled, and so on. The result of this method of management is that a break results with both an upper and lower storey opposed to the velocity of the wind. In addition, there is also being produced small timber and fuel.

V. *Trees Singly and in Groups.*—This type of shelter is more suited for planting in areas devoted to cattle grazing and in the vicinity of homesteads.

To serve as a shelter for cattle the trees may be planted singly or in groups. A modification of the group method

would be to leave the trees planted as an open ring to allow of cattle sheltering inside.

Ant heaps might be planted in some of the cattle rearing areas. The trees used for such shelter might include the Beefwood and Belhambra as extra food for the stock.

Such groups of trees would require protection by fencing until such time as they are no longer liable to damage by stock.

The principles embodied in the aforementioned remarks concerning exotic trees apply to indigenous trees.

General.—Trees should be conserved or planted in water catchment areas and near dams, as they lessen rapid run off and so do much in preventing erosion. They also regulate the water supply and reduce surface evaporation.

In the vicinity of homesteads trees along a drive or scattered individually or in groups have a very real effect in sheltering and beautifying a farm. In addition, they provide restfulness to the mind and an appearance of prosperity to the farm.

Hedges.—Hedges are very beneficial round buildings and gardens, providing both beauty and a lower form of shelter. If it is worth while planting a hedge it is worth while looking after it. Very often poor straggling hedges are seen which, with a little care and attention from the beginning, would have been fine, close and imposing.

The common hedge plants such as Cypresses, Callitris, Camphor laurel, Bottlebrush and Privet should be planted about one foot apart. Tecoma, Mulberry and Hibiscus may be planted three feet apart, and such plants as the Macartney rose, Bougainvillea and Granadilla should be planted with an espacement of five to nine feet. Apart from the conifers and climbers, the above-mentioned plants should be cut back to about six inches when they become established to encourage thick growth. With each foot of growth the hedge should be cut back six inches until the desired height is reached. In order to allow light to reach all parts of the hedge, it should be cut in the shape of a triangle or truncated cone in end view.

The cutting of coniferous hedges should be on the same principles. The entire removal of branchlets and leaves must, however, be avoided, as, ordinarily, these plants do not coppice from the stump.

Choice of Site.—In choosing the ground for planting, the main consideration is the quantity of water available for the trees. It is unwise to plant on shallower soils unless irrigation is to be carried out, as these soils are likely to dry out during the long dry seasons. It is very inadvisable also to plant badly drained areas. The ideal aim is a deep, fresh, well-drained soil which has sufficient sub-soil moisture to carry the trees through the dry seasons.

In areas subject to frost only trees of known frost hardiness should be planted.

Good growth of indigenous trees is a very good indication of good soil for exotic trees. On the other hand, lack of indigenous tree growth does not necessarily mean that such ground is unsuited for tree growth. It may, however, be due to shallowness of soil, a laterite pan or bad drainage. In such cases it is advisable not to plant. If it is considered vital to have some form of shelter on shallow soils, then only the hardiest of trees should be planted and, if possible, irrigated.

Preparation of Land for Planting.—Land for planting should be stumped a year in advance and the wood utilised as far as possible. The material which is not utilisable should be piled and burned and efforts made to conserve fallen leaves and other accumulated organic matter.

It is better to plant in virgin land rather than land which has carried agricultural crops. Soils which have carried crops other than trees are often deficient in organic matter, which is necessary for the life of a tree.

Lack of organic matter in the soil encourages depredations by "white ants." "White ants" prefer dead matter, but if that is not available they are likely to attack living plants.

In worked-out lands weed growth is usually heavy, and unless frequent weeding and cultivating are carried out, the young plants are liable to be robbed of water and to be suffocated.

Thorough ploughing should be carried out in late summer to loosen and aerate the soil and to turn in organic matter. In the following summer the ground should be cross ploughed and a good harrowing given prior to planting.

On sloping ground where soil erosion is feared, a rough ploughing without harrowing is advisable. At the time of planting, a small patch is levelled for each plant with spade or hoe. If the ground is too steep for ploughing, hoeing should be resorted to.

Planting.—The planting distance may be that advised in this country for plantations, namely, ordinary 6 ft. x 6 ft. square planting. Greater planting distances may be used for wind-breaks, as the formation of branchy trees in a wind-break is advantageous. A planting distance up to 12 ft. x 12 ft. may be adopted on the quincunx planting system, which is to say the trees are planted 12 ft. x 12 ft., and in the centre of each square thus formed another tree is planted. Such a system provides an efficient wind-break.

The sites for the trees should be marked on the ground by means of a planting chain. The planting chain may be any form of chain or rope, with the planting distances marked with tags.

Plants are then set out, due regard being paid to the following rules for tree planting: Plant during dull or showery weather; discard plants with poor root systems and cut back roots when too long or bent; take care that the finer roots are not injured when transferring from nursery to planting site; place the roots of the young plants in as natural a position as possible and avoid bending the roots; place the young trees in the ground at the same depth as they occupied in the trays or nursery beds, making an allowance for the settling of the soil.

Cultivating and Tending.—When blanks occur early in the life of the plantations, they should be filled in with fresh plants.

Subsequently the plantation should be cultivated and weeded. This is done in order to conserve the soil moisture and reduce weed competition. A farm cultivator, hoes or spades may be used in this operation. The killed weed

growth should not be removed but left on the ground as a mulch and to decompose into plant food.

In areas where soil erosion is feared, cultivating and weeding should be reduced to a minimum. Weeding should take the form of slashing down, but not cutting out, undesirable growth.

In cultivating, care must be exercised not to heap the soil round the base of the trees. This seriously interferes with the growth of the tree and may eventually cause its death.

Cultivating and weeding should be carried out at least once a year, until the young plantation forms canopy. In the case of the fast-growing species, this may occur after two years, but in the case of slow-growing species, it may be three to five years before canopy is formed.

If the belt of trees planted is to be treated simply as a wind-break, little attention is necessary after canopy is formed. On the other hand, if the objects are to produce timber and fuel as well as shelter, it may be advantageous to carry out judicious pruning, cleaning and thinning.

Great care should be taken in the performance of these operations.

Trees with double leaders should be pruned to a single stem and abnormal branches removed. The pruning of normal branches should be strictly avoided. These will eventually be killed, as the branches of adjoining trees are knit together and light thereby cut off from them. Till then they are carrying out important functions by feeding the tree, by keeping the ground shaded and cool and reducing evaporation from the soil.

"Cleaning" or a light thinning may be necessary soon after the plantation has formed canopy. In this operation only such trees as are diseased, crooked or are interfering with the growth of good trees should be removed.

Thinning is carried out on the same principle. Diseased and suppressed trees should be removed first, and before any of the other trees are removed each should be considered on its merits—whether it is interfering with successful growth of adjacent trees, whether it can be

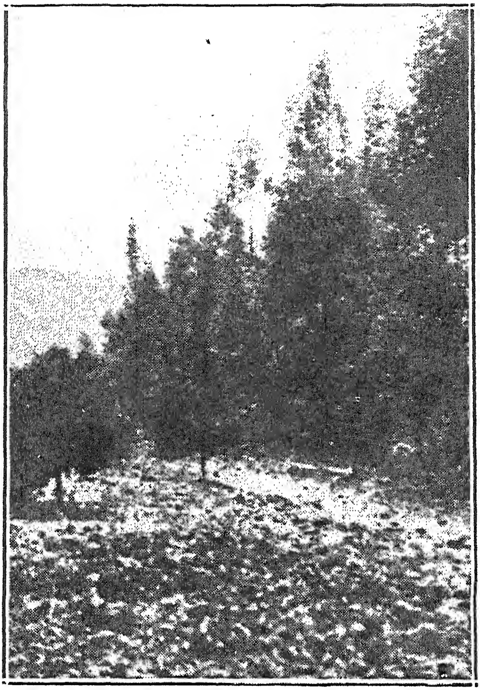


Fig. 3. Wind-break of eucalypts.

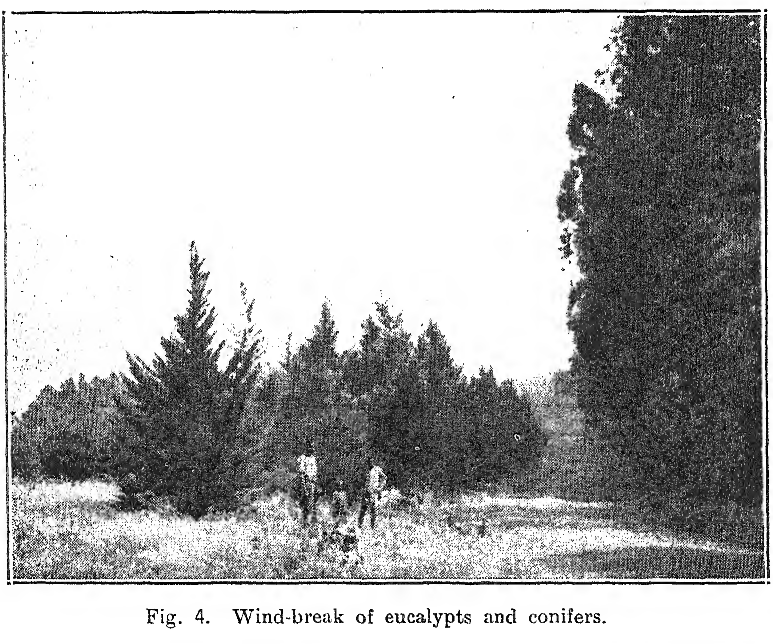


Fig. 4. Wind-break of eucalypts and conifers.

utilised and whether its removal will cause a serious gap in the plantation. Good thinning will increase the increment capacity of the crop and bad thinning the reverse.

Protection.—The most destructive agency to a plantation is fire. Adequate steps should therefore be taken to have the plantation protected from fire by fire breaks. These may be ploughed between which the grass has been burned off.

Fencing may be necessary in the young stages if cattle have access to the plantation.

Suitable Species for Planting.—For wind-break species of Eucalypts, Conifers and other trees are suitable.

Climate and depth of soil must determine whether the hardy or less hardy of the common exotics should be employed for planting. Unless these factors are known, it is impossible to offer definite advice for any particular case.

The following trees are recommended for wind-break plantations, the hardier and more suitable species for general planting being marked with an asterisk:—

Eucalypts.—*E. botryoides*, *E. citriodora*, *E. globulus*, *E. maideni*, *E. maculata*, *E. melliodora*, *E. paniculata*, **E. punctata*, *E. resinfera*, **E. rostrata*, *E. saligna*, **E. tereticornis*.

Conifers.—**Callitris calcarata*, **Callitris robusta*, *Cupressus arizonica*, *Cupressus lusitanica*, **Cupressus torulosa*, **Pinus canariensis*, **Pinus halepensis*, *Pinus insignis*, *Pinus longifolia*, *Thuya orientalis*.

Other Species.—**Casuarina* sp., *Cedrela toona*, **Morus* sp.

TRAP NESTS.

By B. G. Gundry, A.I.Mech.E.

Trap nests of various designs have been tried out at the Government Poultry Station, but the two types described herein have proved the most satisfactory and are recommended with confidence by the officers of the Poultry Division.

The "Roller" Type.—In the following descriptions the two parts of the trap nest are referred to separately, as follows:—

(a) The nest or box in which the hen lays the eggs.

(b) The trap which allows the hen to enter the nest but prevents her leaving it until released.

In the roller type the trap consists of a frame of wood and wire which swings about an axis through approximately 90 degrees between the open and closed position.

The two pieces of board forming the side pieces of the trap or roller should be not less than ¾ in. thick, and, if possible, 8½ ins. wide so that joints are unnecessary. The ends of a petrol box will serve admirably. These end pieces are cut to the shape shown in the drawing and are joined together with three cross pieces. These cross pieces must be cut square at the ends and to exactly the same length, i.e., about 9½ ins. for all breeds or 7 ins. for light breeds only. These dimensions may, however, be varied somewhat if necessary to fit a particular nest box.

The wooden frame of the trap having been nailed or screwed together, the front part is covered with 1 in. or ½ in. mesh wire netting, which extends from the cross piece B to the crosspiece C. The dimensions given for locating the holes for the axis bolts about which the trap revolves are taken from the actual trap from which the drawing was

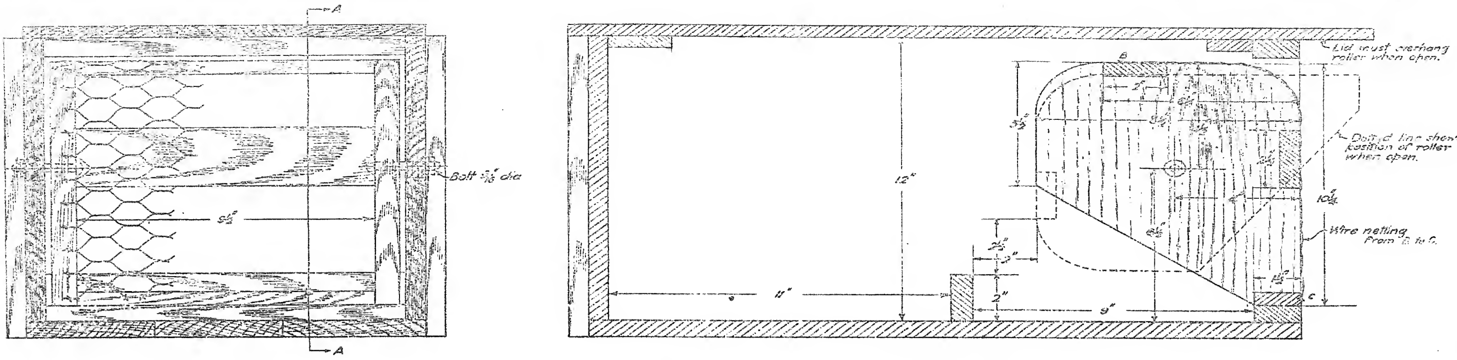
made, but it must be realised that any appreciable variation in the details of construction may result in these holes having to be placed somewhat differently; it is advisable, therefore, before drilling the bolt holes to test the balance as follows: Drive a thin nail into each side at the point given by the dimensions, $4\frac{1}{2}$ ins. from the top edge and 4 ins. from the front edge. Now support the trap temporarily by these nails and hold it in the open position, raise the back gently two or three inches as would be done by a hen entering the nest. If the trap is properly adjusted it should then overbalance and fall gently into the closed position. If it does not function correctly, the position of the nails should be altered as indicated by its behaviour until it does so.

If any difficulty is experienced in ascertaining the correct position for the axis bolts, the following procedure may be adopted: Hold the trap between the points of two nails held firmly in the hands in such a way that it will balance about its centre of gravity like a wheel; the correct position of the nails will be determined after a few trials. Now, from the dents made by the nails—which should be exactly opposite each other on either side of the trap—measure off a distance of $\frac{1}{2}$ in. from this point away from and roughly in line with the top right hand corner of the trap when facing to the right. This point will be the position for the bolt holes, which can now be drilled.

Care should be taken that these traps are not too delicately poised, or they are liable to be closed by accidental causes.

The nest box in which the trap is fitted should be approximately of the size shown. The inside width should be about $\frac{1}{4}$ in. wider than that of the trap to permit the latter to swing freely. The height of the back cross piece of the trap, when open, above the front edge of the nest should be not less than $2\frac{1}{2}$ ins. or more than 4 ins., and the trap might, if convenient, be set a little further back in the box than that shown.

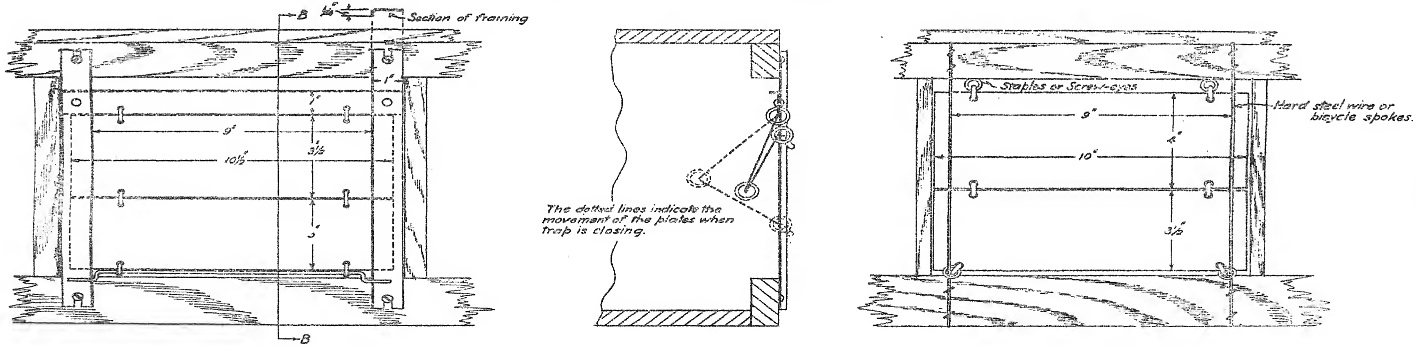
If the trap, when open, projects beyond the end of the box as it does in the drawing, the lid or a fixed piece of wood must project just beyond it so that it will not be accidentally closed by a bird alighting on it.



FRONT VIEW

SECTION ON A-A

TRAP NEST – "ROLLER" TYPE.



FRONT VIEW
(Trap shut)

SECTION ON B-B
(Trap open)

FRONT VIEW.
Showing alternative method of construction.

TRAP NEST – "VENETIAN BLIND" TYPE.

Scale: 0 1 2 3 4 5 inches.

Irrigation Division.

The trap may be swung on ordinary screws or even nails, but bolts, as shown in the drawing, will be found very much more convenient and reliable, as with them the trap can be set in the proper position and will remain in adjustment.

Before drilling the holes in the box for the axis bolts, it is as well to place the trap in the open position in the box and hang it temporarily with thin nails driven into the sides of the box from inside the trap; its correct placing can thus be determined.

When completed, the trap nest should be painted inside and outside with some insect-resisting compound such as carbolinium.

The "Venetian Blind" Type.—There are two methods of constructing this type of trap. In the first, the two thin metal plates which are linked together by wire rings are suspended from a metal frame, the sides of which form a guide for the lower plate as it slides up and down. In the second method the top plate is attached direct to the upper edge of the nest box, and the lower plate is guided by two rigid vertical wires also attached to the front of the nest box.

The first method of construction is most suitable, where the traps are to be fitted to a battery of nests arranged in rows or tiers, each compartment having its own trap.

Both the frame and the plates are made from flat galvanised iron of 22 or 24 gauge.

The frame consists of three strips of this material 1¼ ins. wide and of the required length, one edge of which must be turned to a right angle to give it the necessary rigidity. The turning of these edges may present some little difficulty, and the following method of procedure is suggested: If a carpenter's or fitter's vice is available, the edge of the iron to be bent may be inserted between the jaws to a depth of ¼ in. and tightly gripped in this position. The projecting metal can now be bent over and hammered down flat to form a neat angle. If the jaws of the vice are not long enough to take the full length of the iron, two pieces of hard wood of the required length may first be placed in the vice and the iron held between them. Failing a vice, the iron can be

gripped between two such strips of wood held together by small bolts.

The horizontal cross piece may be attached to the vertical side members by $\frac{1}{8}$ in. diameter tinsmith's rivets. The various holes in the plates and frame should be drilled with a twist bit.

The wire bent in the form of a double crank which holds the lower plate in position can be made from ordinary 10 G. galvanised fencing wire.

As in the roller type, the width of the opening, i.e., the distance between the side members of the frame, may vary from 7 ins. for light breeds to $9\frac{1}{2}$ ins. for heavy breeds.

The alternative method of construction, as shown on the right of the drawing, is somewhat simpler and is recommended when petrol tins are used as nest boxes, as no frame is required.

The wires on which the lower plate slides must be smooth, straight and parallel. Bicycle spokes are suggested, but any type of wire may be used provided it is sufficiently stiff and springy to resist permanent distortion by normal use.

TSETSE FLY OPERATIONS IN LOMAGUNDI DISTRICT.

(UMBOE AND SIPOLILO AREAS).

By R. W. Jack, Chief Entomologist.

In the *Rhodesia Agricultural Journal*, February and March, 1926, an article appeared, entitled "Tsetse Fly in the Lomagundi District," in which a history was given of recent aggression of tsetse fly in the Umboe and Sipolilo divisions of that district and also an account of measures undertaken by the Government to combat the menace.

For details concerning the nature of the country and the aggression of the fly, the reader is referred to the article in question, which is still in print as Bulletin No. 587 of the Department of Agriculture.

It may be recalled that the position at that time was very menacing, and that cattle were dying freely from trypanosomiasis (fly disease) on a number of farms both between the Angwa and Hunyani Rivers and on the eastern side of the Hunyani River. In the same area native cattle were decimated by the disease, and native cattle were also dying freely in the northern part of the Sipolilo Reserve and adjacent country. The whole outlook afforded a clear prospect of extensive evacuation of occupied country.

Operations.—The game drive between the game fences which was carried out in November, 1925, although apparently successful at the time, does not appear to have had a very marked effect on the prevalence of game between the fences. In any case a considerable amount of game remained or found its way back into the area. The operations may be said to have commenced in earnest during the last few days of the year 1925. They were carried out by

native hunters, supervised by a European ranger, distributed over the approximately 300 square miles of country enclosed by the game fences and the Hunyani and Angwa Rivers, the area being about 30 miles long by 10 miles wide. The maximum number of hunters employed in this section was eighteen.

In September, 1927, hunting operations were extended northward to the triangle formed by the Hunyani and Mvume Rivers and the northern game fence.

In July, 1928, operations were extended to a ten-mile zone north of the northern game fence, and a third game fence cutting off the new zone was completed in November of that year. This fence was extended eastward across the Hunyani River to the Impinge River in the Sipolilo sub-district. At the western end the new zone was closed by a cross fence more or less parallel with the Angwa River.

In February, 1930, operations without fencing were extended to the west of the Angwa River, due to indications that the fly was tending to outflank the original area of operations.

In 1931, following the general improvement in the position, it was decided to reduce costs, and the number of paid hunters was reduced from 42 to 12, whilst 30 rifles were issued to selected unpaid hunters resident in the area. Both paid and unpaid hunters remain still under the supervision of the ranger.

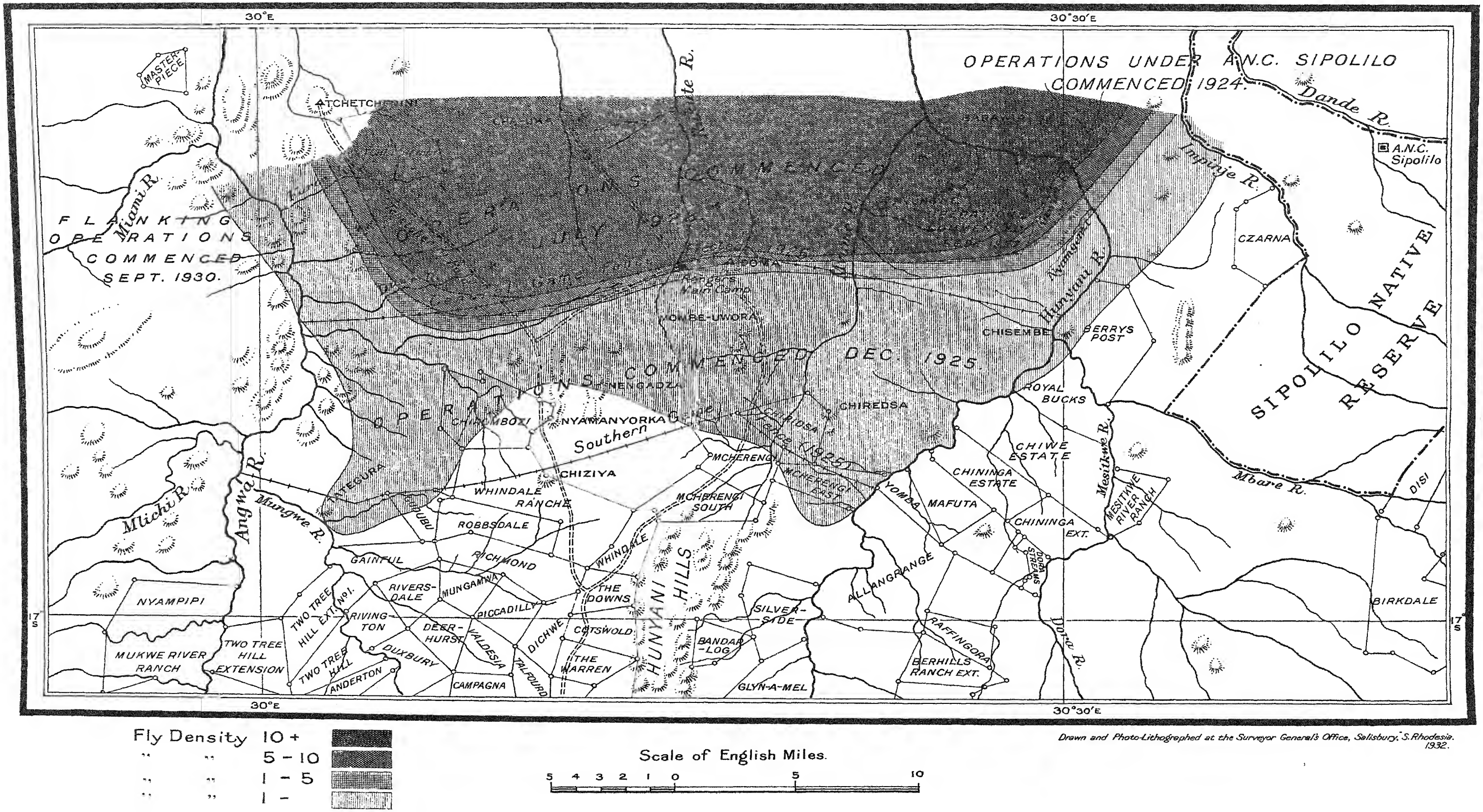
From 1924 supplementary operations have been prosecuted by unpaid native hunters resident in the Sipolilo sub-district under the general direction of the Assistant Native Commissioner at Sipolilo.

Game Fences.—The game fences in the Lomagundi district now consist of seven strands of barbed wire, gauge $12\frac{1}{2}$, and are six feet high. The top wire is 18 inches above the next, and three wires are then concentrated about $7\frac{1}{2}$ inches apart, as at this height they take the weight of the average big buck running into the fence.

Considerable experience with these fences has now accumulated not only in the Lomagundi (Umboe) area but elsewhere, and on the whole they have proved reasonably

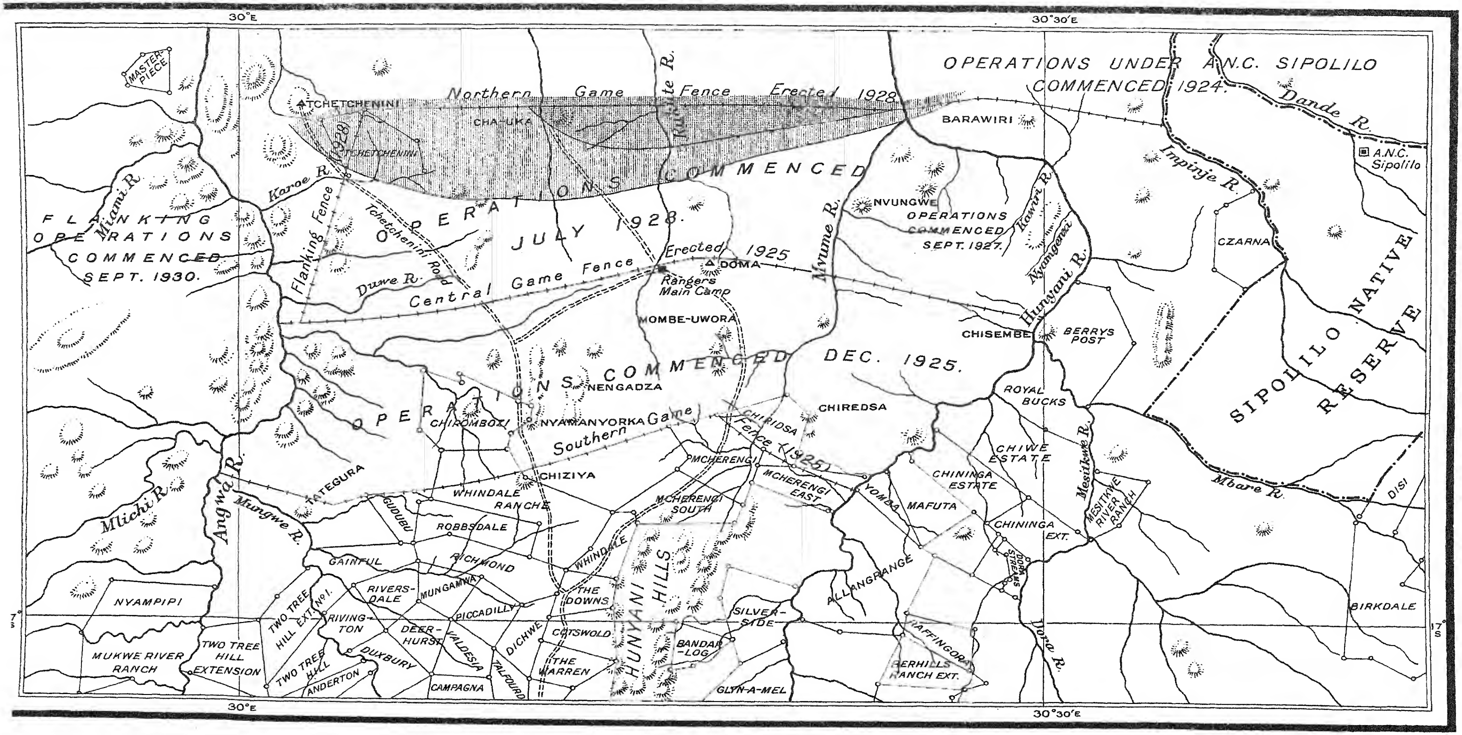
TSETSE FLY OPERATIONS LOMAGUNDI (UMBOE) 1925-26

Nº 1.



Nº 2.

TSETSE FLY OPERATIONS LOMAGUNDI (UMBOE)
Dec.– April, 1931-32



Drawn and Photo-Lithographed at the Surveyor General's Office, Salisbury, S. Rhodesia. 1932.

Scale of English Miles.

5 4 3 2 1 0 5 10

Fly Density 1 – 5

" " 1–

satisfactory. They might, of course, be made both higher and stronger with advantage, but the additional expense involved is an important consideration. Koodoo or even eland can clear a six-foot fence, but in practice they generally fail to see the isolated top wire and so sustain a fall, which seems to deter them from repeating the attempt. As far as strength is concerned, a stampeding herd hitting the fence at right angles breaks through, but this does not occur very often. The experience is that for a period after the new fence is erected, breakages are frequent, but that they diminish almost to the vanishing point in course of time.

The fences would, of course, not be of much avail in areas where elephant and rhinoceros are common, but in the areas where they have been erected they serve a very useful purpose. It should be mentioned that they are regularly patrolled, and breakages are repaired daily. They are also protected from fire each year, and poles are renewed when necessary. As far as possible, living trees and "live poles" are utilised, but in some areas the latter are lacking, together with durable wood. This unfortunately necessitates the use of perishable poles.

The fences in the Lomagundi (Umboe and Sipolilo) area are now altogether about 120 miles in length.

Tsetse Fly.—From the year 1926 an effort was made to obtain an exact knowledge of the distribution of the fly, three special field inspectors being engaged for this purpose. These inspectors were mostly engaged in searching for fly in the areas where trypanosomiasis was prevalent amongst stock, that is, on the extreme boundary of the fly-infested area, and also between the two first erected fences. On Map 1, illustrating this article, the results of inspection in the years 1925 and 1926 are shown by various shadings indicating the distribution and density of the fly as ascertained by direct inspection.

It may be noted that density is calculated on the basis of the number of male flies caught in one net in an hour. It will be noted that, except close to the second fence, this density was under one, and in actual fact was very much

so in most places. Flies were scarce in the area marked, but were to be found by intensive search.

The area north of the second fence was maintained as a temporary game reserve in 1926 and 1927, and was known to be heavily infested with fly on the basis of traverse by various officers of the Entomological Branch. It was not until 1927, however, that detailed density counts were made. Mr. J. K. Chorley, Entomologist, was stationed in this area in that and the succeeding year, studying the effect on the tsetse of organised grass burning, and obtained a series of figures based on fortnightly collections in certain selected localities from August to December, 1927.

It is to be noted that practicable methods of estimating density do not give closely comparable results, but they do, of course, give results which are reliable on broad lines. It is, in fact, remarkable how consistent results from comparatively rough methods have proved in various districts.

In the first fenced area the scarcity of fly was such that decrease in density with progress of the operations could not be registered. It was merely a question of complete disappearance.

In the second fenced area decrease is indicated on broad lines by the following figures, based on fortnightly collections in certain selected localities:—

Average male density, 1927 (August-December)	34.4
Average male density, 1928 (June-December)	24.0
(Hunting commenced in July, 1928.)	
Average male density, 1929 (July-December)	5.8
Average male density, 1930 (July-December)	1.5

The figures from 1927 to 1929 refer to exactly the same localities, but the figures for 1930 include other localities, close to the northernmost fence, where the fly was known to be particularly abundant in previous years and still persisted in greatly reduced numbers.

Special inspection covering the whole year in 1931 and part of 1932 show continued diminution of fly. The returns for this period are numerous and mostly negative. They would be difficult to analyse to a definite figure comparable

with the above, but there is no doubt that this figure would not amount to more than a small decimal point.

The position in 1932 is shown on Map II., which, compared with Map I., gives a clear indication of the diminution and retrogression of the fly in the area of operations. It may be stated that total elimination of tsetse fly from the zone immediately adjacent to the northernmost fence is probably impossible without extending the operations further north. This zone seems to be populated by flies which range over the fence from the undisturbed country beyond.

It is interesting to note that figures collected in a small zone extending 4 miles *north* of the northernmost fence and adjacent to the more densely infected area south of that fence show a progressive diminution from the year 1929. Comparable figures for two localities on the Wendi and Rukute Rivers respectively each four miles north of the fence gave an average male density of 32.4 for 1929 and 16.0 for 1930, but these only cover the period from late September to early November, and the number of collections is insufficient to give a fair comparison with the fenced area. The average male density for the whole year in 1930, including a traverse not utilised in 1929, was 20.7. In 1931 the figure comparable with 1930 is still lower, the average male density being 10.1. Collections in 1932 seem to indicate further diminution. During 1931 and 1932 it was also ascertained that the density of the fly decreases from the four-mile points southward towards the fence.

This diminution in an undisturbed area is probably partly attributable to the fence, which bars access to the favoured grazing grounds around the Chipingabadza River, a small affluent of the Rukute River, within the fenced area and not far (about 2 miles) from the northernmost fence. The Wendi and Rukute Rivers flow through broken country beyond the fence, and this affords poor grazing. The game which formerly frequented this area and grazed on the Chipingabadza has now been either destroyed or has largely left the locality. The reports of the inspector have latterly indicated great scarcity of game on this traverse, whereas the earlier reports indicated that game, including rhinoceros,

was comparatively plentiful. The diminution may also be partly due to the factors dealt with under "Overflow of Fly Across Game Fences" (q.v.).

In the adjacent Sipolilo area it has not been possible to follow events quite so closely, but, when the fence was being erected in 1928, fly was plentiful along the fence line from the Hunyani River to about half the distance to the Impinge River. Recent inspections (1931) have failed to reveal fly in this region except close to the Mvume-Hunyani confluence. It is to be noted that the native hunters under the direction of the Assistant Native Commissioner have been operating both north and south of the fence in this sub-district.

Game.—It is not possible to furnish comparative figures concerning the reduction of game in the fenced areas, for the reason that the zone of operations has been extended from time to time and the number of hunters has varied. At the commencement of the operations in the first fenced zone game was comparatively abundant, the hunters securing 896 head in 1926, of which 554 head consisted of animals the size of bushbuck and over. In 1927, in the same area, the total was reduced to rather over half, of which only one-third were of the larger size. At present the whole of the fenced area is practically free from the larger species, although an odd animal occasionally breaks in or invades the area from west of the Angwa River.

It may be noted that the presence of considerable numbers of *baboons* has not prevented the disappearance of the fly. It is known that tsetse will attempt to feed on these animals and that flies are frequently picked up in the wake of a stampeding troop. Baboons, however, do not seem to constitute a source of blood on which the flies can feed economically. They are irritable under attack, and it is possible that they and also monkeys catch and destroy a considerable proportion of the flies which attempt to feed upon them, in which case they would need to be regarded as allies rather than otherwise.

Man.—It has often been contended, and not only by laymen, that destruction of the game in any area would lead to the tsetse feeding more and more upon man. It can only

be said that in these and previous operations there has been no indication at all of the fly concentrating on man, and the presence of a considerable native population has not prevented the retrogression of the fly in the area under review.

Tsetse flies frequently obtain a meal from man, but like baboons and monkeys, man is an irritable host, and, of course, kills the flies whenever he can. In general, in common with some other investigators, the writer is inclined to the opinion that *morsitans* cannot feed economically on man, and the probability appears to be that man, baboons and monkeys can all be classed together in this respect.

Trypanosomiasis.—The final test of the success of any operations against tsetse fly must lie in ability to keep cattle in the area it is desired to protect. This is a very exacting test in Southern Rhodesia owing to the extreme susceptibility of European-owned cattle. Intensive search occupying months of continuous work has to date invariably failed to reveal the presence of tsetse over the whole area in which cattle are liable to contract trypanosomiasis. There appears to be no doubt that odd flies range from the definitely infested area for very considerable distances. In addition they may, of course, be carried by travelling man or vehicle or game. Traffic can, however, be controlled to a large extent.

The further the distance from the definite fly area, the less in general is the chance of wandering flies coming into contact with cattle, but there are indications of favoured avenues along which flies wander, so that a farm nearer the fly belt may escape whilst one further off is affected.

The aim of operations of the type under review is to put a sufficient distance between the occupied country and the definite fly area to place the farms beyond the reach of ranging flies. Incidentally, of course, potential carriers of fly in the shape of game animals are largely eliminated and vehicular traffic is brought under control. Effective control of pedestrian traffic is, however, very difficult, if not impracticable.

During the year 1926 the position on the farms remained very serious, in fact the disease was more widespread than previously. The following farms sustained more or less

serious losses, namely:—(1) Between Hunyani and Angwa Rivers: Gudubu, Robbsdale, Riversdale, Mungamwa (?), Two Tree Hill (?), Mcheringe. (2) East of the Hunyani: Chiwe, Silater, Mafoota, Mafoota Extension, Chisanga, Allangrange, Msitkwe River Ranch. Gudubu and Msitkwe River Ranch were evacuated during that year. Native cattle between the Hunyani Range and the Hunyani River south of the fenced zone were also seriously affected. It should be pointed out that the above information may not be complete. When not suspected, losses from this disease are liable to be attributed to poverty.

The year 1927 showed a considerable improvement, especially east of the Hunyani River, where all the farms were free from the disease except the most northerly and nearest to the fly area, namely, Chiwe Estate. Between the Angwa and Hunyani four farms were affected, namely, Robbsdale, Riversdale, Whindale and Mcheringe. The last-named was evacuated during that year.

The improvement was more than maintained in 1928, when all the farms east of the Hunyani remained free, except Chiwe, and even on this farm five spans of oxen were worked and only three cases recorded, of which two were probably relapses. Between the Angwa and Hunyani only one farm was seriously affected, namely, Riversdale. Intensive inspection carried out on and around this farm in 1927 and 1928 failed to reveal fly anywhere in the vicinity.

In 1929 the position east of the Hunyani River remained much as before, but an outbreak of the disease occurred on Chiwe. Between the Hunyani and Angwa Rivers two farms, namely, Robbsdale and Riversdale, sustained losses. Two spans of oxen were worked on Mcheringe without loss. These animals were injected with an antimony preparation as a prophylactic. Unfortunately a farm not known to have been affected previously and considerably removed from the fly area sustained an outbreak, and two tsetse were actually caught on the farm. Heavy losses, attributed to poverty, are, however, stated to have occurred on this farm previously and were not reported. This farm, it may be noted, is on the main road and traffic route from the fly area. It has since been fenced and no further cases have been reported.

In 1930 the danger of sporadic incursions was again demonstrated by reappearance of the disease on two farms on the east side of the Hunyani River, namely, Mafoota and Allangrange, which had been free since 1926. On Mafoota three head died, and the number of cases on Allangrange, which is the further from the fly area, was estimated at 23. The outbreak may have been due to fly transported by motor vehicles. The cases all occurred during the earlier part of the year, ceasing after August, and none have occurred since. Twelve cases were reported on Chiwe Estate during that year.

Between the Hunyani and Angwa Rivers in 1930 cases occurred on three farms, but the losses were small. Tsetse flies were taken on Robbsdale by the owners during this year, but a thorough search by an inspector and ten natives failed to reveal any definite infestation.

It is to be noted that in 1930 and the early part of 1931 certain mining activity was in progress close to Robbsdale and the southern game fence, one property being within the fenced area and one without. This entailed car journeys to the north centring on the mine. It also concentrated native traffic to this vicinity. The catching of flies on Robbsdale is tentatively attributed to this traffic.

Two spans of oxen again worked on Mcheringe farm during 1930 and no losses were sustained.

In 1931 the only cases recorded occurred on Robbsdale, but the losses were comparatively light.

During the present year the disease has reappeared on Riversdale, which had been free since May, 1930, and several head have died. No other farms have been affected this year.

In addition, there is no doubt that cattle have been ranging freely over land adjacent to the southern fence for some considerable time, and no cases are known to have occurred. This region was carefully avoided a few years ago, the aim being to keep cattle as far south as possible.

An evacuated farm in this region is now being cautiously restocked with cattle.

It may be added that early in the operations native cattle south of the southern fence between the Hunyani

Range and the Hunyani River were evacuated on account of severe losses from trypanosomiasis. With the general improvement in this position after 1928, cattle were permitted to return to this locality, a process which took place gradually. No cases of trypanosomiasis are known to have occurred amongst these cattle since their return. Cattle have not yet been allowed to return to the area between the fences.

It will be seen, therefore, that whilst there still remains some risk of infection the outbreaks have become isolated and sporadic, whereas at the commencement of the operations the cattle were dying freely all round the salient of the advancing fly.

During the earlier part of the operations more farms would certainly have been evacuated if the Government had not come to the help of the farmers with cattle and financial assistance. Had a measure of relief from the incidence of the disease not occurred between 1926 and 1927, more or less general evacuation must have occurred over the whole "front."

The experience in this Colony during the past quarter of a century has been that the tendency of the fly is steadily to encroach towards the limits of its distribution in the past century. No retrogression of the pest has been recorded anywhere except where direct efforts have been made to drive it back. The Umboe Flats, now in agricultural occupation, are known to have been heavily infested with tsetse during the past century, and also the valley of the Hunyani River in the same region. It may be stated with confidence that had the advance of tsetse not been stayed by the operations, the fly would have gradually enforced the evacuation of farms over the whole of the Umboe Flats and much additional country.

The farmers in the district have not been slow to recognise the danger with which they have been confronted, and on more than one occasion, through their associations, have expressed their appreciation of the Government's action.

Sipolilo Sub-District.—The operations in this district, according to reports from the Assistant Native Commissioner, have had an equally satisfactory result. In 1926, 141 head

of cattle are reported to have died from the disease. In 1927 the number of cases is given as 29. In 1928 the Assistant Native Commissioner summed up the position as follows:—

1. There were no deaths due to fly.
2. The Sipolilo Reserve is free of fly.
3. Fly are decreasing between Impinge and Hunyani Rivers, south of Mt. Barawari.
4. Game is diminishing.

In 1929 the report was also that no deaths had occurred and that both game and fly were still diminishing. It may be noted that whilst cattle have been withdrawn from the most forward positions, they have been present throughout at certain kraals which sustained heavy losses from 1924 to 1926.

Reports for 1930 and 1931 were similarly favourable, although in 1931 one headman lost 14 head through allowing his cattle to stray into the fly area.

The menace of fly encroachment has been removed from this sub-district at comparatively small cost.

Fly Incursions.—The chief trouble connected with tsetse fly still causing anxiety to the farmers in this district is the danger of occasional incursions leading to infection of their highly susceptible cattle. Other animals are rarely infected in areas subject to such incursions. These incursions are sporadic and may apparently take any direction, although certain routes seem to be rather favoured.

It is natural when a fresh farm has suffered an outbreak to deduce that the fly has spread to a new locality and to infer, therefore, that the operations are not achieving their object. Experience shows, however, that these sporadic outbreaks are to be expected within a certain, or rather *uncertain*, distance of a definite fly area, and the fact that they do not constitute actual spread of fly to a new locality is generally demonstrated by their temporary character.

The distance from the definite fly area at which outbreaks of trypanosomiasis may occur is remarkable. An outbreak occurred some years ago (1924) amongst pigs in the Mazoe district at least 60 miles from the fly area. Similarly, in 1927 an outbreak occurred amongst cattle in the

Lupane Valley in the Shangani Native Reserve 30 or more miles from the fly area. In the Lomagundi district farms 20 miles from tangible fly have sustained outbreaks, and the position in the Hartley district is similar. Such outbreaks may be limited to one or two animals, but it is strongly suspected that under certain conditions the disease is spread amongst associated animals by means other than tsetse fly "bites." A considerable number of cases may occur in this way.

It has been usual to look to traffic or game movements for an explanation of such sporadic outbreaks, but traffic at least does not explain the position satisfactorily in many instances. The first occupied farm passed by the main road from the fly area in the Lomagundi (Umboe) area is Richmond, and this farm has never had a definite case of the disease.

The most difficult outbreaks to explain are those on Riversdale. This farm and the vicinity have been frequently and intensively searched for fly since 1926 and no tsetse has been found either on the farm or anywhere in the vicinity. The farm has, however, been affected by trypanosomiasis with two fairly long breaks since that year, and the losses have been considerable. The breaks occurred (1) between April, 1927, and August, 1928—17 months; (2) between May, 1930, and February, 1932—21 months. It is curious that the neighbouring farms, Robbsdale and Riversdale, have tended latterly to alternate in sustaining outbreaks. They are both situated close to a definite range of hills running north and south, and this may be a favoured route for fly incursions.

The situation within the fenced zone is now so satisfactory that it is permissible to hope that incursions will become still rarer, if they do not cease altogether. Riversdale farm is now about 20 miles from the edge of the definite fly area, and still further from any spot where fly now occurs in measurable density.

Overflow of Fly Across Game Fences.—The experience with operations against game conducted in this Colony is that the fly gradually recedes from its extreme limits towards the main fly area, it being understood, of course, that the

operations straddle the limits of the fly at the commencement. Where hunting towards the main fly area is rigidly limited by a game fence, however, it has not so far been found possible to effect elimination of fly as far as the fence, notwithstanding the fact that game conditions near the fence are no more favourable to the fly than elsewhere within the zone of operations. It is, in fact, apparent that the fly overflows for a considerable distance from the undisturbed country beyond, irrespective of game conditions in the country penetrated. Conditions are such in many places that the phenomenon cannot be attributed to flies being carried either by game, man or vehicle. In other words, they appear to range spontaneously on the wing.

Opportunity of demonstrating this movement by marking large numbers of flies has been lacking, but it seems reasonably clear that it occurs, as (1) the fly only persists in the strips adjacent to the further fences, (2) the highest densities within the fenced zone are found in country adjacent to the highest densities beyond the fence, and (3) density of fly gradually diminishes from the fence towards the centre of the fenced zone.

This overflow is continuous and not sporadic, the areas affected maintaining a more or less constant, but in reality gradually diminishing, density. This fact seems to throw some light on fly movements. The distance to which overflow or free ranging occurs may be at least three or four miles, dependent upon the density across the fence, and in lesser number the fly may penetrate still further until the zone of sporadic incursion, penetrated only by occasional flies and lacking definite density, is reached.

Another point worth recording is that the tendency appears to be for the fly gradually to diminish on *both* sides of the limiting game fence, a phenomenon which may be in some degree due to the fact that the original density on the undisturbed side was partially maintained by circulation of flies from the side now rendered unproductive by removal of the food supply. In other words, the undisturbed side of the fence does not now receive accessions of flies, produced across the fence, to compensate for those lost by movement in the opposite direction.

The deduction from the foregoing is that in order to free an area of tsetse fly by operations against game, it is necessary to operate beyond it, as well as within it, presuming, of course, that an effective barrier to fly movements cannot be interposed.

Given such a barrier, which is at present apparently impracticable in the *morsitans* areas in this Colony, it appears quite possible that in a limited area elimination of tsetse might be brought about by intensive operations against game very much more quickly than has been the case up to the present. It is judged, in fact, that results are greatly delayed by constant invasion by flies generated beyond the zone of operations.

Consolidation of Position.—Results achieved by driving back the game on the edge of an extensive fly area are generally recognised as being of a potentially temporary nature. This was well demonstrated in the Gwaai-Shangani region where the fly, driven back by operations between 1919 and 1922, obtained sufficient new momentum by 1927 to affect cattle again along the Gwaai River and since then to infest a considerably greater area. History would no doubt repeat itself if the operations were suspended in the Lomagundi (Umboe) area.

This has been realised from the first, but the alternative of allowing the occupied area to be overrun by the fly was unthinkable, and, therefore, the only practicable measure was adopted.

It has been thought that whilst the fly was being held back by temporary measures, research proceeding in various parts of Africa might reveal some better and more permanent method of dealing with the menace or some method of giving permanency to results obtained by operations against game. Unfortunately we are still without any sufficiently economic method of creating a permanent barrier against the fly's advance in the class of country involved.

Possibly the temporary nature of results from present methods has been rather over-stressed. Indefinite expenditure is contemplated by civilised countries generally in connection with maintaining a guard against various evils and permanent officials are maintained with this object. No

artificially created barrier against tsetse fly can be conceived which would not involve indefinite expenditure in maintenance. Total elimination of fly in this and adjoining countries alone could give finality to results.

It is to be noted that in the Sipolilo sub-district the cost of checking and driving back the fly has been limited to the supply of rifles and ammunition to some 30 odd natives and that there is every prospect of the position being maintained indefinitely by this procedure. The same procedure has been adopted in other districts with a view to preventing further spread of the fly rather than reclaiming ground from it. It has proved considerably easier to check spread of tsetse than to cause it to evacuate any appreciable area of country. In areas where the fly is actually infecting cattle on the farms and threatening to dislodge settlement, comparatively costly operations with the object of driving back the pest far enough to place the farmers beyond the range of fly incursions are unavoidable, but once this object has been attained, the holding back of the fly should, in certain districts at least, cost very much less.

The feasibility of holding back the fly through the simple procedure of arming native hunters depends, of course, upon the density of native population in the district concerned. In some districts unfortunately there is little or no native population, and the country is unsuited to supporting more than a very few widely scattered kraals. These districts constitute a difficult problem.

In the Sipolilo sub-district the position is unusually favourable. There are ample natives, and the Assistant Native Commissioner is situated in the area of operations and can control the natives effectively.

A move was made last year in the direction of reducing expenditure in the area under review without sacrificing the results obtained. This took the form of reducing the number of paid hunters to 12 and arming a number of other unpaid natives, all being under control of the resident ranger. This arrangement appears to have worked satisfactorily to date.

Other Districts.—The operations in Lomagundi (Umboe and Sipolilo sections) have been longer in prosecution than

those elsewhere. In some other districts the position is not as yet so satisfactory.

The next oldest operations are in the Hartley district, and this has been found a considerably more stubborn area to deal with than Lomagundi (Umboe). This fact is attributable to several factors. In the first place the fly was much denser close up to the occupied country than in Lomagundi. Secondly, the forest is more uniform, affording more cover to game; and thirdly, the area is poorly supplied with permanent water, a fact which hampers the hunters. Game will travel far to water, but the radius of effective hunting from a permanent water supply is limited.

None the less, the fly is gradually receding westward in the fenced area in the Hartley district, and is now only to be found in any considerable density at certain spots close to the western fence. With a view to bringing about further retrogression as speedily as possible, extra hunters have been engaged and a further ten mile width of country brought within the scope of the operations. The full result of this is not likely to be apparent for several years, and the position may appear worse rather than better in the meantime.

In the Lomagundi S.W. area the operations were started in 1930 as soon as the first cases of disease appeared on the farms, and further development of the trouble appears to have been prevented. The position in this area is satisfactory at present.

In other districts the operations have been inaugurated too recently for definite results to be apparent.

General.—The exact effect on the fly of radical reduction of game is somewhat uncertain. Investigations carried out by Mr. J. K. Chorley, of the Entomological Branch, in the second fenced area in the Lomagundi (Umboe) district in the years 1927, 1928 and 1929 revealed little in this connection beyond the facts that the density of the fly was rapidly declining, that the remaining flies were hungry and that some change was apparent in the percentage infestation of the flies with the different species of *trypanosomes*, the last suggesting a change in the animals from which the flies were obtaining blood.

The results of investigation in different parts of Africa to date indicate that the tsetse is guided to its food supply mainly through the sense of vision. Consequently the larger animals constitute the most readily detected source of blood, although, in short-grassed country, such animals as warthog are very conspicuous and are much preyed upon by the fly.

The effect of intensive hunting is probably twofold. In the first place, the food supply is reduced to a minimum, and in the second place, the habits of the animals are changed in a way which tends to break up their association with the fly. The animals become timid and retire to the hills or other retreats away from the fly during the day, coming down to the lower levels, which are frequented by the fly, during the night, when the flies are generally inactive.

It is known that the fly needs comparatively frequent meals to maintain both life and breeding activity. Under the very artificial conditions of confinement, they need a feed every two or three days, but recent work in Tanganyika has suggested that in nature they feed normally about once every five days.

Under undisturbed conditions in the presence of an abundant food supply the fly, of course, may increase or at least maintain its numbers. Under conditions which lead to irregular and only occasional meals it is evident that the fly tends to diminish. It is thought that this is due to decline in the breeding rate and, no doubt, increase in the death rate. There are no indications that the fly as a whole migrates from such disturbed areas, although there are certain indications that it tends to range further afield for a period, possibly in search of food.

It has been suggested that, whilst reduction of game may be expected to result in diminution of fly, actual extermination is not to be expected from this measure. The argument appears to the writer to be theoretically unsound and has not been borne out in practice.

The vital factor is not the quantity of blood present in any given area. One buck might afford sustenance to quite a large number of flies. The vital factor is the frequence of opportunity of feeding. In this respect, if the game and fly are largely disassociated, due to change in habit and scarcity

of the former, a few fly have no more opportunities of obtaining regular meals than a large number. Once conditions are such that the fly is decreasing for lack of regular sustenance, maintenance of these conditions should theoretically result in the decrease continuing until the fly dies out altogether.

It is necessary to realise that although the tsetse flies will follow moving animals for limited distances in the day time, they do not maintain indefinite contact with herds of game and follow them in their wanderings. If they did there could apparently be no such phenomenon as a definite fly belt. The flies are in general dependent upon finding a fresh source of food each time they need to feed, and are also apparently largely dependent upon animals penetrating into their particular habitat.

The apparently complete disappearance of resident flies from the whole of the first fenced zone and a large portion of the second fenced zone in the Lomagundi (Umboe) area indicates that elimination is not only possible through extensive hunting of game but that it is the natural sequence of events if the operations are sufficiently maintained.

It may be added that, whilst the question is no doubt debatable, the writer is not convinced that scattering of game from a fly-infested locality by hunting has more than a very temporary, if any appreciable, effect in spreading fly. Most investigators are also of opinion that the fly has a "homing instinct" and tends to return to the "fly belt" if carried some miles out of it by game or other agency. This also seems to be a necessary corollary to the existence of definite fly areas, but the question requires further investigation.

Finally, it is necessary to state that the view that tsetse can support itself upon food obtained from *vegetable* sources is altogether unsupported by the extensive research carried out by official investigators in various parts of Africa.

It must not be inferred that operations against game are regarded as a fully satisfactory or desirable means of controlling tsetse fly. The limitations and drawbacks, not to mention general distastefulness of this method, are fully realised. The operations have been undertaken simply in default of any better method of saving the Colony from being

overrun by tsetse, a pest which, as far as agricultural and pastoral industry is concerned, at present carries all before it.

It unfortunately has to be admitted that the prospect of discovering feasible alternative methods of controlling tsetse (*Glossina morsitans*) over the wide areas involved in this Colony seems decidedly remote, at least until both population and revenue have increased considerably above the present figures. Certain lines of research are, however, being prosecuted with this end in view, and the Entomological Branch is in touch with work proceeding in other parts of Africa.

Summary of Chief Points.—1. Operations against game were commenced in the Lomagundi (Umboe) area at the end of 1925 in a fenced zone approximately ten miles wide adjacent to the occupied area, where heavy losses of cattle from trypanosomiasis were being sustained.

2. The operations were extended in July, 1928, to a new fenced zone about ten miles wide adjacent to the first zone on its northern side.

3. The advance of the fly ceased with the commencement of the operations.

4. The fly showed definite signs of retrogression from 1927 onwards, and at the present day the limit of the definitely infested area has receded to a minimum distance of 15 miles and a maximum distance of over 20 miles, tangible infestation being now confined to a narrow strip adjacent to the northernmost fence, where its continued presence is almost certainly due to overflow from outside. The area reclaimed from infestation is roughly 500 square miles in extent.

5. Trypanosomiasis in the occupied area has greatly decreased, being now confined to occasional outbreaks on isolated farms. Only one farm has been affected during the present year, and only one—a different farm—last year.

6. Evacuation of farms has ceased, and the present tendency is for new land to be taken up rather than the reverse. Native cattle have been returned without loss to certain areas whence they had been evacuated on account of

trypanosomiasis. One previously evacuated farm has been worked for two years without loss and another is being re-occupied cautiously at the present time.

7. The cost of the operations has now been considerably reduced without apparent loss of efficiency.

SALES.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

Spineless Cactus Slabs (blades) Algerian variety, per 100 slabs, 7/6 Salisbury, or 12/6 delivered free by rail to purchaser's nearest station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Stocks are limited and delivery cannot be undertaken after 15th November.

Kudzu Vine Crowns, per 100 crowns, 15/-, Salisbury, or 25 crowns, 7/6; 50 crowns, 15/- and 100 crowns, 22/6, delivered free to purchaser's nearest station or siding in Southern Rhodesia. Delivery during September and October for irrigated land, and in January for dry land. Owing to pressure of other operations, it is not possible to deliver Kudzu crowns during November and December.

Woolley Finger Grass: 10s. per bag of roots, delivered on rail nearest station or siding; supplies limited. Available January and February.

The prices quoted above do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

NOTES ON AFRICAN ALOES.

By H. Basil Christian, Ewanrigg, Arcturus.

PART III.

Aloe Excelsa.—This is the only tall-stemmed aloe so far recorded in Southern Rhodesia and is one of the most striking looking aloes we have in this Colony. It is widely distributed in granite country and occurs in scattered colonies right across Southern Rhodesia. As often as not it is found growing in the shade of trees. It is one of the tallest of the arborescent aloes, growing to a height of up to 30 feet. The plant illustrated measured 26 feet to the bottom of the rosette of leaves, but unfortunately was broken off 11 feet from the top when being lowered to the ground for transportation to its present site.

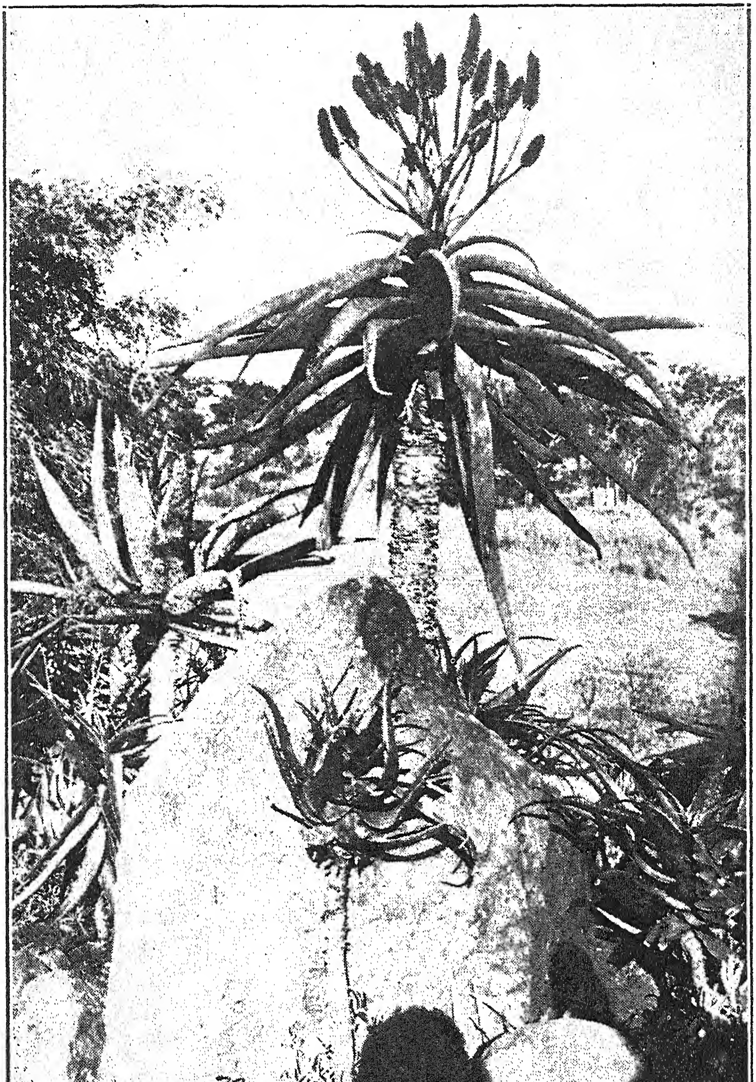
The leaves grow to a length of up to 6 feet, with spines on the margins and underside, but these latter vary considerably in numbers. One finds plants growing side by side, the one with hardly any whilst the other is copiously studded with spines on the under surface.

The inflorescence is a panicle, one or more from the same rosette of leaves. The racemes are densely flowered up to 12 inches long, with the flowers deflexed, usually with from 10 to 15 racemes from the same peduncle. When the flowers open the stamens and style project for a considerable distance beyond the end of the perianth.

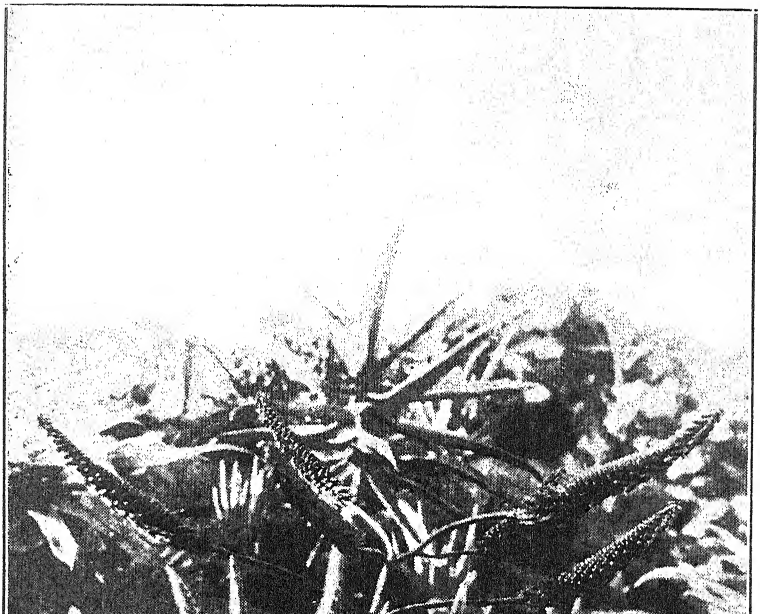
The colour varies from a light orange to blood crimson.

This aloe flowers from the end of July into September.

Aloe Marlothii, Lobatsi Variety.—*Aloe Marlothii* occurs in Bechuanaland, the Transvaal and Natal and varies considerably in habit of growth in the three separate localities. It is an arborescent aloe growing to a height of from 12 feet to 15 feet.



A. excelsa.



A. Marlothii (Barberton variety).

The Lobatsi Bechuanaland variety has pale, glaucous leaves up to 4 feet long, which are concave-convex in cross-section and have prickles on the margins and on both upper and lower surfaces.

The primary branches of the inflorescence are horizontal. The flowers are more or less secund, or turned to one side, and not arranged to form a cylindrical raceme.

The flowers are light yellow in colour and when open the stamens and style project for some distance beyond the end of the perianth.

This aloe flowers with me in August.

Aloe Marlothii, Barberton Variety.—This variety of *Aloe Marlothii* differs from the Lobatsi variety in that the leaves are not so strikingly pale glaucous in colour, having a decidedly greener tinge, and are not so copiously studded with prickles on the upper and lower surfaces.

It is an arborescent aloe and the primary branches of the inflorescence are horizontal and the flowers more or less secund. The young flower buds are yellow shading to green below and red above—later on as the flowers develop and open out becoming yellow below and red towards the apex. The stamens and style project for a considerable distance beyond the end of the perianth.

This aloe flowers under Rhodesian conditions in July.

EXPORT OF GRADED GROUND NUTS.

By H. G. Mundy, Dip.Agric. (Wye), F.L.S.,
Chief, Division of Plant Industry.

In terms of Article 5 of the Ottawa Agreement between the Imperial Government and the Colony of Southern Rhodesia, His Majesty's Government in the United Kingdom undertakes that the general *ad valorem* duty of 10 per cent. imposed by section 1 of the "Import Duties Act, 1932," on

ground nuts from sources outside the Empire, shall not be reduced except with the consent of the Government of Southern Rhodesia.

This pronouncement may well prove of very considerable importance to Southern Rhodesia Constant endeavour has been made to establish the ground nut as a major exportable product of the Colony since July, 1914, when, at the request of the farming community supported by the Administration, the British South Africa Company in its commercial capacity, opened the first local oil expressing works—the Salisbury Oil Factory. Rhodesian soil and climatic conditions are eminently suitable for the growing of ground nuts, and it was hoped that the provision of a local oil factory would stimulate production and enable an export industry in nuts and their by-products to be developed.

The many difficulties encountered during the intervening years are familiar memories to those who have been closely associated with the business. Viewed as a whole, the industry—on the production side at least—has made little material headway, and the annual output of nuts by European farmers has remained for some years at a figure of about 50,000 to 60,000 bags, to which, however, native production adds a not inconsiderable quota of nuts of somewhat inferior quality, suitable, however, for oil-crushing purposes.

Several enterprising individuals, together with the Farmers' Co-operative Society, Ltd., Salisbury, acting on behalf of its members—and more recently the Rhodesian Milling and Manufacturing Company, Ltd., Salisbury, have praiseworthily continued to exploit to a limited extent the overseas market for high grade nuts in the shell, and generally these exports have met with satisfactory prices and marked appreciation in Great Britain. For the trade in question, choice nuts in a clean, unblemished shell are required, and material progress has been made in devising practical methods of washing and scouring or bleaching to the required degree, crops of which the shells through being grown on the red clay loams of the Colony, are of an undesirable colour. Simultaneously experience has been acquired of grading the nuts in accordance with market requirements and knowledge has been gained of the requisite field methods necessary to ensure heavy yields per acre.

Foreign competition in United Kingdom markets for graded nuts in the shell, and for graded kernels has been encountered in the past from China and Java, but the 10 per cent. preference to be accorded to Empire grown nuts, aided in certain cases by the exchange should now, it would appear, afford Rhodesia the opportunity of establishing herself as a regular supplier of these commodities to the Home market. Certain information is still required in respect to the type of nut likely to find most favour, and in regard to the specific requirements of certain sections of the trade. It is known that the most commonly grown variety, locally called "Spanish Bunch," in the form of graded nuts containing three to four kernels in each shell has met with an excellent reception, but it is not yet definitely established whether the Colony should specialise in this type or some other. It may be that other kinds are particularly suitable for certain branches of trade.

A definite overseas interest in the purchase of Rhodesian nuts has been apparent for some time and in the hope of benefits to be derived from the Ottawa Conference, the Division of Plant Industry has instituted enquiries through the Imperial Institute, London, and the High Commissioner's Office, upon points on which further and more precise information seemed desirable. Though not yet available, it is expected that the resultant reports should come to hand in time to permit of publication in the next issue of the *Journal*.

Meanwhile, however, it is known that "Spanish Bunch" nuts properly graded do meet a definite demand. Needing, as we do, so urgently, a wider range of exportable products, it would be an infinite pity if these possibilities were not taken the fullest advantage of in the immediate future. In order to do so a sufficient acreage must be planted to ground nuts during the coming season to enable export on a reasonably large scale to be carried on. Small, intermittent shipments will not attain the object. Export should be regularly maintained between the months of August and March, at a rate of at least some 500 to 1,000 bags of graded nuts a month.

The crop must not be treated—as so often it is—as one of minor importance in respect to choice of soil on which it is to be grown and subsequent field operations. Given the

best treatment, yields of 15 bags (1,125 lbs.) per acre and up to half as much again, can be secured over the greater part of the settled area of the Colony. Heavy acre yields are not, however, alone sufficient; when selling or exporting red shelled and white shelled nuts must be kept separate and the utmost care must be taken to free the sacks of nuts from soil, small stones, cracked and damaged shells and similar impurities, and finally to grade and if necessary wash or bleach the product in accordance with market requirements. (Grading by Government officials may later prove desirable.)

Some difference of opinion appears to exist in regard to the desirability of scouring or bleaching the shells. One British firm interested in the business considers shells of a "golden" colour the more popular. Any discolouraton of the shells due to adhering soil or other causes, is definitely injurious to sales, but it would seem that the best demand may be expected from clean, unblemished shells which retain their natural bloom.

In the initial stages of establishing a regular export the producer, apart from the hope of eventually securing better prices, should be satisfied if, on account of their high quality, he can sell his nuts more readily than his Empire competitors.

Yields of Graded Nuts and Prices.—It has been variously estimated that the yield of graded nuts containing three to four kernels in a shell should normally average some 35 to 45 per cent. Given careful attention to the crop in all phases it is probable that this percentage can be improved upon. Prices for nuts—three in a shell—have recently ruled at £30 per long ton and £35 per ton for four-kernelled nuts. The market has later weakened, but somewhere around £25 to £30 per ton should usually be obtainable for the best grades. Costs of export amount to about 6s. to 6s. 6d. per bag of 75 lbs. Thus on a crop of 1,500 lbs. per acre, 40 per cent. of which will grade into "threes and fours," selling overseas at £27 10s. per long ton, the return should be somewhat as under:—

	£	s.	d.
600 lbs. at £27 10s. per long ton, say	£7	7	4
900 lbs. of inferior nuts at, say, 4s. per bag on farm	2	8	0
Total return per acre	£9	15	4

Transportation charges to England may be taken at the higher figure of 6s. 6d. per bag, and on the eight bags of graded nuts exported, the cost would be £2 12s. 0d.

Second-hand grain bags can be used, and putting these at 6d. each, a figure of 10s. will be expended on bags. Washing and scouring costs about 1s. per bag or 8s. on the portion of the crop exported. Thus a figure of about £6 5s. 0d. per acre would remain to cover cost of production, separation into grades having three to four kernels to the shell and grower's profit.

This return compares well with that obtainable from any other Rhodesian crop, barring tobacco, and it therefore appears that farmers interested in ground nut growing should now make a concerted effort to capture a portion of the United Kingdom trade in graded nuts in the shell and possibly, too, in graded kernels.

Extract from the *Rhodesia Herald* of the 20th October, 1932, in which the speech of the Treasurer, the Hon. P. D. L. Fynn, on the inter-Empire agreements entered into at the Ottawa Conference, was reported:—

> "An important item in the Canadian agreement was pea nuts (monkey nuts). Canada has agreed to extend to Rhodesia the same preference as that granted to Australia, namely, to allow our peanuts in free, as against a duty on foreign pea nuts of one cent per lb. There was a proviso in the Australian preference, however, that as soon as Australia satisfied Canada that she could supply all Canada's pea nut requirements they would place a duty of four cents per lb. on the foreign product. That meant 2d. a lb., and if Rhodesia could help Australia to supply Canada's needs it might prove a big thing.
>
> "This duty of one cent per lb. was equal to 3s. 1½d. per bag of unshelled pea nuts, or 5s. 7d. per bag of shelled pea nuts. From this they could calculate to what extent the duty would be increased if it were raised to four cents. Most of the foreign pea nuts came from China, and there was a prospect of Rhodesia being able to build up a big trade in this direction."

PASTURES AND THEIR MANAGEMENT.

NOTE.—*In the September number of "Farming in South Africa," there appeared an article by Dr. I. B. Pole-Evans, Chief, Division of Plant Industry of the Union, on "The Union as a Pastoral Country."*

In the first section of this article the natural grazing regions of the Union were discussed with special reference to altitude, rainfall, prevalence of frost, etc.

Although the conditions indicated might apply to some extent to different regions of this Colony, it is felt that sufficient information is not yet available to be able to indicate how nearly the areas possessing similar altitude and climatic conditions actually approach those indicated in the Union.

It is felt, however, that the information given in the remainder of the article will be of particular interest to Rhodesian farmers, and sections 2, 3 and 4 are therefore reprinted and will, we are sure, be appreciated by everyone interested in this important subject.—Ed.

PASTURE INVESTIGATIONS.

In the early days, the natural veld was sufficient for all the grazing required, as there was plenty of it and fewer animals to feed, but now, largely as a result of over-grazing and over-stocking, veld-burning, etc., veld deterioration has taken place, and it is found that the natural veld has to be supplemented, and therefore the question of "pastures" is an all-important one.

The original efforts to supplement the natural veld took the form of introducing exotic grasses and fodder crops. These to a large extent were unsuccessful, owing chiefly to the peculiar and exacting conditions of our soil and climate, and quite early it became clear that something more than this was demanded. Hence, as far back as 1913, this Division began a scrutiny of the individual pasture grasses of the

country, and quite early on in the investigations the fact was revealed that we had indigenous grasses of the very highest value, and such as were well adapted for the laying down of permanent pastures under the various conditions existing throughout the Union's grasslands.

Our Own Grasses.—The outcome of these investigations was that the stoloniferous species and strains of Finger grass (*Digitaria*) proved to be undoubtedly the most valuable pasture grasses in the country and work has consequently been concentrated on them.

Various species and strains of stoloniferous Finger grass are now known to occur throughout south, east and central Africa, and where they occur in any quantity they yield by far the most valuable grazing. On account of their creeping habit, high protein and mineral content and general palatability, they are eminently suitable for the laying down of permanent pastures. Many species and strains have been collected, mainly through the medium of the Botanical Survey, and tested out at Pretoria, and are now available for distribution and trial throughout the Union.

Other botanical investigations on grass have been carried out mainly by the Cedara School of Agriculture, by Professor Bews at the Natal University College, Pietermaritzburg, and by Professor Schönland, late of Rhodes University College, Grahamstown. Schönland, under the auspices of the Botanical Survey, carried out a valuable piece of work on the regeneration of depleted veld on the Amatola Range. He showed that by proper management it was possible to restore the veld to its original condition in a comparatively short space of time.

To Bews this country is indebted for much valuable information regarding the grasses and grasslands and their distribution in South Africa.

Staples, at Cedara, investigated the effects of grazing and burning the veld in the mistbelt where there is an average rainfall of 36 inches. His main finding was that burning annually during the winter encouraged the growth of "Rooigrass" (*Themeda*)—the dominant pasture grass throughout the Union—while heavy grazing destroyed it.

Mineral Content of Grass.—In 1905, Ingle, of the Division of Chemistry, Pretoria, was the first to draw attention to the fact that far too little consideration had been given to the diet of animals with respect to the mineral contents of their feed, and pointed out the possible relationship between this and disease in stock in South Africa.

Vipond, of the same Division, some nine years later, published analyses of a dozen hay grasses grown under South African conditions, and emphasised strongly the views previously put forward by Ingle.

Theiler and the staff of the Division of Veterinary Research, in 1924, gave an account of experiments carried out in Bechuanaland to demonstrate the importance of phosphorus in the nutrition of animals, especially when they were kept under the ordinary conditions of veld-grazing.

Since then, chemical investigations of pasturage have loomed large in agricultural literature. Chief amongst these has been the work of Henrici on the composition of the natural pasturage of Bechuanaland, the Transvaal High Veld, the Coast Belt (unpublished) and the pastures of various other parts.

Van Wyk, of the Division of Chemistry, co-operating with this Division, has made a detailed study of the relative food values of the different species and strains of *Digitaria* growing at the Pretoria Pasture Research Station.

The results of all these investigations go to show that South Africa possesses a wealth of highly nutritious fodder grasses which only need propagation and attention to yield valuable returns.

Following on these investigations is the recent work by Hall of the African Explosives Company on the application of fertilisers to grazing veld. Hall has shown conclusively that under varying conditions throughout the Union's grasslands the application of phosphorus and nitrogen not only increases the palatability of the veld, but also improves its general feeding quality considerably.

LAYING DOWN OF PASTURES AND THEIR MANAGEMENT.

Sufficient has been said above to indicate that, taken as a whole, the natural grazing veld of the Union is not ideal

for raising "beef." It has, however, been pointed out that there exist in many parts of the Union natural pastures of great value—although limited in extent—and many valuable indigenous species of grass. These are usually found in the more protected habitats, or in places where the soils are richer than usual. It is these grasses which have been sought out by the Division of Plant Industry, by means of the Botanical Survey, and are being made available for the improvement of natural grazing. They include perennial species of such genera as *Digitaria*, *Panicum*, *Urochloa*, *Dactyloctenium*, *Chloris*, *Pennisetum*, *Agrostis*, *Rottboellia* and many others. Most of these are stoloniferous species, and are eminently suitable, therefore, for propagation by stolons or runners. One of the principal difficulties encountered up to the present has been that of obtaining good viable seed of many of these grasses, and after considerable experience it has been found that it is both cheaper and more satisfactory to establish pastures through the medium of runners rather than by seed; especially has this been the case in seasons of uncertain rainfall.

In the laying down of pastures, too much emphasis cannot possibly be laid on the importance of selecting the best soils for the purpose. The soils should be thoroughly well prepared, and the ground freed as far as possible and practicable of all weeds.

Before pastures are laid down on any scale, it is well to establish nursery plots of the desired grass, so that expense is avoided in the purchase of "roots" and also to ensure that an adequate supply of planting material is on hand when conditions are favourable.

Planting can be done at any time during the wet season, but the best results are frequently obtained towards the end of the season, when the rains are more certain and the atmosphere is cooler.

Grazing should not take place until the new plants have thoroughly established themselves and made vigorous growth. Even then the grazing should be light, and no heavy grazing should take place until the grass sward is complete.

It is, of course, essential that all artificial pastures be carefully fenced and paddocked. Once the pastures are

firmly established, they should be grazed as uniformly as possible, avoiding both overgrazing and undergrazing. As soon as grazing is complete, the pasture should be rested until a new flush of growth appears, and then it should be resumed.

Overgrazing in the spring months should be avoided at all costs, and in no circumstances should old growth from a previous season's growth be allowed to remain over for the following season. Manuring or fertilising the pastures must form the most important part of pasture management. Heavy grazing can only be counterbalanced by heavy manuring. Fertilisers will not only improve the general palatability and feeding value of the pasture, but they (especially nitrogenous manures) will induce early growth of the pastures. Phosphatic and nitrogenous fertilisers are just as essential for pastures as for crops; in fact, the actual return from pastures is far greater.

Detailed information regarding the most suitable indigenous grasses for laying down to pasture for the different regions and areas can be had on application to the Division of Plant Industry.

RANCHING AND VELD MANAGEMENT.

The writer, after long observation, has been struck by the lack of intelligent interest the majority of farmers take in the veld which provides the all-essential pasturage. They are slow to detect the marked and rapid changes which invariably take place in ill-treated veld, and it is only when the veld has been ruined and the pasturage reduced to vanishing point, that the Department is called to their assistance. There are, however, some remarkable exceptions to this, but they are few and far between.

The problem of handling stock without serious injury to the veld is of the greatest economic importance, and requires the most careful study on the part of the farmer. It is probably the most complex of all his operations. He is dealing with two entirely different biological units, the grazing animal on the one hand and the living plant on the other. No hard and fast rules can be laid down in dealing with matters of this kind, but his personal experience of his local conditions will be his main stand-by in this respect.

The same fundamental principles apply to ranching and veld management as pertain to the management of pastures. Uniform grazing of the veld should be aimed at. This can only be obtained by a complete system of camping, and the smaller the camps, the more efficient will be the grazing. Changes in the veld, such as encroachment of weeds, the growth of thornbush, a change in grass composition and the occurrence of bare patches, should be immediately noted and the causes thereof sought. In other words, the influence of the grazing animal on the veld at different seasons of the year should be carefully studied. The average South African farmer is endowed with remarkable powers of observation, and these should be directed above all things to veld changes.

The provision of adequate watering places is one of the first essentials both in the establishment and management of a ranch. Without this, maltreatment of the veld will naturally occur. Every opportunity of conserving surface water, by making both temporary and permanent dams, should be seized upon. The important matter of veld erosion should also receive most careful consideration and prompt attention. The renovation of bare patches by the restoration of grass can in many cases be readily brought about by simple methods, such as the felling of thornbush for the protection of such areas. The encouragement of stoloniferous or creeping grass in this connection should also receive special attention, especially as South Africa is remarkably fortunate in the possession of a great number of valuable pasture grasses belonging to this class.

Rotation System of Grazing.—A definite rotation system of grazing should also be adopted, whereby each camp in turn is allowed to reach maturity each year before grazing is permitted. In the United States, an ingenious system, known as "Deferred Grazing," has been worked out and practised, with highly satisfactory results. There is no reason whatever why the same system should not be adopted in the Union, with perhaps suitable modifications. The system, as stated by Sampson,* is as follows:—

* Sampson, A. W., "Range and Pasture Management," page 74, 1923.

"The essential principles of the deferred grazing system are:—

(1) An overgrazed area, sufficiently large to supply the forage from the time of seed maturity until the end of the grazing season, is protected from stock until the seed crop has matured.

(2) Upon maturity of the seed crop, the forage is grazed closely during the first season, but not to the extent of injuring the seed plants.

(3) The same area is protected to about the same date in the second season and longer, if necessary, or until the new plants have been thoroughly established.

(4) When the area has been satisfactorily re-seeded, it is grazed early in the season, and a second area, of sufficient size to accommodate the stock from the time of ripening of the seed to the end of the grazing season, is protected until the forage has matured.

(5) Alternating the grazing after seed maturity from one area to another is continued, not only during the period required for the re-stocking of each selected area, but even after the deferred portions have been fully re-vegetated. This plan not only keeps the vegetation vigorous at all times, but results in the formation of an occasional seed crop."

Veld-burning.—This method of veld treatment will naturally bring into prominence the question of old grass or roughage. Every endeavour should be made to make stock remove the previous season's crop of grass before rotting or souring of the veld takes place. This should be done either by the use of a herd boy or by special paddocking. If it cannot be accomplished by these means, then resort must be made to burning. Burning of the veld, however, is certainly not recommended as a general ranch practice, but circumstances may arise where it becomes necessary to employ burning every third or fourth year, especially if surplus pasturage cannot be removed either by stock or by cutting for hay or ensilage. Much more use of the grass crop could

be made throughout the country if it were cut for hay and ensilage early in the summer than is at present done.

Thousands of tons of valuable feed are destroyed annually through deliberate burning of the veld. Had this, however, been removed when it was young and succulent, it would have furnished ample provision for winter and lean times. Important developments which are being made by science in the preservation of young succulent grass in the form of grass bricks would seem to offer great possibilities for the future of a great grass country like Southern Africa.

Summary and Conclusions.—The eastern half of the Union is essentially a grass country, which falls naturally into three regions:—A central temperate region—the High Veld—a pure grassland, which, on account of its high elevation, has a relatively short growing season. A surrounding tract of sub-tropical country—the Middle Veld or Bush Veld—of lower altitude and with a longer growing season. An eastern coastal and low-lying region of tropical character—the Low Veld.

The bulk of the natural pasturage forms fair grazing during summer, while good winter grazing is limited both in quantity and extent.

Many valuable indigenous grasses eminently suitable for the laying down of artificial pastures of high quality are found in these grasslands.

The natural occurrence of these grasses is restricted, as they grow mainly on the more fertile soils.

Fertile soils are essential for good pastures.

In laying down permanent pastures of these valuable grasses, the best soils must be chosen, and in addition these must be kept constantly fertilised to maintain the value of the pastures. Good pastures furnish the cheapest means of providing good beef.

It is a fact worthy of mention here that the natural grasslands of the Union are also the regions which produce the cattle-food concentrates.

Farmers have to alter their entire outlook with regard to grass and pastures. They have to look upon grass as the most valuable asset they possess. It must receive the first

consideration in the management of their farms and ranches. In such circumstancs only will the beef industry forge ahead.

The preservation and improvement of the natural pastures on which up to the present the entire stock of the country has been raised have received practically no attention whatsoever from the farmer, and it says much for the enormous properties of endurance possessed by these pastures that they are in existence at all—although dilapidated—when we consider how they have been treated with regard to overstocking, overgrazing and veld-burning.

FARMING CALENDAR.

November.

BEE-KEEPING.

Now that the first honey flow is on, be sure the hives stand level, whether working them for extracted or section honey. This is important, saving annoyance when preparing the product for market. Occasionally, where bees have not been thoroughly subdued, they object to the removal of honey; postpone the operation for 24 hours. Where increase of stocks is required, artificial swarms can now be made. Use care in storing honey.

CITRUS FRUITS.

If no appreciable rain has fallen, irrigation must be resorted to in order to keep the trees in good growth and to prevent any check to fruit development. This is a good month to plant green crops. Sunn hemp is possibly the best crop to smother weed growth and supply humus-forming material after it is ploughed in. If not already done, storm drains should be made on the sloping ground to prevent erosion of the surface soil during heavy storms. Where new plantings are contemplated, the holes should be dug and everything got in readiness for planting if the trees are ready for lifting in the nurseries. All unthrifty trees could with advantage have an additional amount of fertiliser and manure applied during the month. Keep down all water shoots.

CROPS.

Take note when the first rains fall, and see what leaks there are, if any, in the farm buildings. Do not neglect to effect such repairs as are necessary. Early in the month see that the planters are in perfect order, and that they drop the different seeds to be planted evenly and at the right distance. Try them out on the farm road. Hasten the work of getting the lands for early sown crops into as good a condition for seeding as possible, so that the first and most favourable opportunity for planting may be seized. The young plants make more rapid growth in a good seed bed. Utilise exceptionally early rains for this purpose rather than for planting. The holes for check-row planting of maize can continue to be prepared until sufficient rain has fallen to allow of planting. Velvet beans and dolichos beans for seed or hay may be planted dry if the land is in good order. With favourable weather, planting of maize, velvet and dolichos beans and cotton will commence about the middle of the month, and will continue as the condition of the land and the rainfall permit. Main crop potatoes should be planted from now on to January. Dhal may be planted for seed or green manuring—if for seed, a frost free situation is necessary. Kaffir corn for seed may be planted this month. Green-manure crops requiring a long growing season should be planted. Destroy, by feeding or burning, early planted trap crop of maize or volunteer plants which have become infested with stalk-borer.

If weeds are beginning to show, keep the harrows going in front of the planters. If weeds are too advanced to be killed by drag harrows and too numerous to be dealt with by hand labour, use the disc harrow or lightly re-plough the land. If the tilth is good, do not be afraid to harrow the young maize. This will save much labour later on by destroying the weeds while they are small.

DECIDUOUS FRUITS.

Continue thinning out fruit on the trees if a very heavy setting has occurred. A small amount of large-sized fruit is preferable to a large crop of small fruit. Thin down the inner growth of new shoots if they have a tendency to crowd each other, and stop all suckers and main stem growths as they appear.

ENTOMOLOGICAL.

Maize.—Crops planted before the last week in this month are liable to suffer later from stalk borer. At Salisbury, crops planted after 27th November have escaped serious injury, but early December plantings are probably the safest. Volunteer maize is commonly badly infested and should be cut out and removed immediately, otherwise the borers tend to spread to surrounding plants. If rain has fallen sufficiently early, lands may be baited at the end of the month against surface beetles, snout beetles and other pests which tend to reduce the primary stand of plants. The formula is arsenite of soda 1 lb., cheapest sugar 8 lbs., or molasses 1 gallon, water 10 gallons. Dip chopped Napier fodder or other green stuff and distribute broadcast. The poison may be sprayed over volunteer maize and weeds on land with good effect. Cutworms do not usually appear in numbers until December, except in low-lying land. Succulent green stuff soaked in a 2 per cent. solution of sodium fluoride is the most recent formula for poisoned bait, but destruction of these pests is difficult. Keep the land clear of weeds as a preventive measure. If the young plants are attacked by the black maize beetle (heteronychus), the only remedy is to destroy by hand. Good, clean farming will control these pests to a large extent.

Tobacco.—This crop is subject to many pests in its early stages, although attacked by a few after vigorous growth has started. Keep cheese cloth covers on seed beds at night to exclude pests, and spray regularly with arsenate of lead (powder) 1 lb. in 30 gallons of water to protect against leaf-eating insects, etc. Lands may be baited against surface beetles with maize bran moistened with arsenate of soda 1 lb. in 30 gallons of water. Distribute in balls about the size of a golf ball and cover over with branches or anything to protect from sun. Place one ball to each ten plants and moisten again when dry.

Potato.—The first brood of leaf-eating ladybirds appear in November. Spray with arsenate of lead (powder) 1 lb. in 30 gallons of water. Spraying is also useful against the black blister beetles, which sometimes attack the crop on sandy soils. Keep the soil of irrigated crops well hilled and in friable condition as a precaution against tuber moth laying eggs on the tubers.

Kitchen Garden.—Plants of the cabbage family are liable to attack by diamond-back moth and other leaf-eating insects. When considered desirable, young plants may be dusted lightly with arsenate of lead (powder). Cabbage aphis may be kept in check by liberal watering and frequent washing with a forceful stream of water from a hose pipe or spray pump. Drenching the plants regularly with cold water is also held to be a good remedy for the diamond-back moth mentioned above.

Deciduous Fruits.—Young trees may need spraying with arsenate of lead (powder) 1 lb. in 20 gallons of water as a protection against chafer beetles, whose attack may check the growth very seriously. Choice varieties of early peaches may be netted to protect them from fruit-piercing moths.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

All seeds may now be planted. Annuals for January flowering should be sown, amongst which the following will be found to do excellently in this Colony:—Balsam, Calliopsis, Centurias, Chrysanthemum, Dianthus, Escholtzia, Marigold, Mignonette, Gallardia, Phlox, Poppy, Nasturtium, Nigella, Verbena and Zinnia. These are all hardy, and may be sown in the open either in beds or in the position desired for flowering. Advantage should be taken of each shower of rain during this month to keep the soil well worked and loose.

VEGETABLE GARDEN.

All vegetable seeds may be sown during this month. Tomatoes and early peas and beans should be staked. The soil should be kept loose and free from weeds, which now get troublesome. Sow pumpkin, mealies, peas and potatoes.

FORESTRY.

Sowings of eucalypt (gum) seed should be made for late planting. If fresh seed of cedrela toona is available, sowings should be made. Keep the seed beds moist and free from weeds. The tap roots of early seedlings may be cut back in order to form hardy, stocky plants most suited for planting. Continue with pricking out if transplants are to be used.. Prepare all land to be planted by cross-ploughing and harrowing. A well prepared soil is a good fertiliser; it assists establishment and reduces failures.

POULTRY.

Some birds will now be commencing to moult. This will cause a decrease in the number of eggs laid. The poultry keeper, therefore, should see that his birds come through the moult as quickly as possible. Some birds will lay and moult simultaneously, but these are the strongest, most vigorous and the best layers; the majority do not. The process of moulting is a natural one, but it is a severe strain on the system. Fowls that are not too fat, and can stand extra feed at the commencement of the moult, come through it best. More green and animal food should be given, and the utmost care taken that they are not exposed to cold or wet, otherwise they will not only take longer to moult, but go off in condition. A little linseed stewed, or linseed meal, or ground nut meal and milk should also be given. There will next month be a demand for table birds, and such as the poultry keeper intends to sell should be selected. In making this selection, it is no use choosing old or scraggy birds, for it is hopeless to attempt to fatten these, or make them good table birds. Do not coop them up till a fortnight or so before they are to be sold; give them free range and feed them well, with at least one feed of soft food mixed with milk once a day. Turkeys destined for the Christmas market should have free range, but also a feed of soft food once a day, and a good feed of mealies in the evening.

STOCK.

Cattle.—Normally rains should have fallen and the veld should be plentiful now. Beyond careful dipping, ranchers should not have much worry. If the season is bad, the poorer cattle should be drafted out and given a little hay, ensilage or maize daily. The grazing should be improving rapidly in feeding value. If normal rains have fallen, the grass should be sufficient for cows of average production. Heavier milkers should be fed concentrates at the rate of about 3 lbs. per gallon of milk produced over the first. In most cases maize meal alone will be sufficient for the purpose.

Sheep.—Dip sheep; put the rams to the ewes; keep the sheep on high dry land; be sure the kraal or sheep shed is dry and clean, and that there is shelter from the rain for young lambs.

DAIRYING.

In a normal year veld grazing should be plentiful in November, and the feeding of dairy stock is then very much simplified; veld grass in a green and succulent condition is practically all that is required for animals of less than average production. Heavy milking cows, however, on early pasture, require extra feed in the form of concentrates, while the latter should always be fed to dairy stock which are in poor condition at this time of the year. Young calves should not be turned out to graze with the herd, and in wet weather are best kept in a clean, dry, airy pen. Weaned stock, which have not hitherto had access to green pasture, should be gradually accustomed to the change in diet and may at first be turned out to graze for short periods. Young stock on pasture should also receive a small daily allowance of concentrates.

Farmers supplying cream to the creamery should adjust the cream screw to the separator so that the latter will separate a cream testing 45 to 50 per cent. butter fat. Cream of this consistency will keep better than thinner cream. It should be borne in mind that it is practically impossible to produce first-grade cream if the cattle are milked in a muddy kraal. In the absence of a cow shed, every endeavour should be made to erect a small milking shed in which four or five cows can be tied, milked and fed. A small shed of this kind is also essential to obtain clean milk for cheese-making. Milking in a muddy kraal invariably results in a gassy, bitter cheese being produced.

The shelves of the cheese room should be scrubbed with boiling water and soda, and for the last rinsing a weak solution of formalin may be used. This should prove effective in controlling cheese pests.

TOBACCO.

Continue to sow seed beds, watering, etc. When early beds become overgrown and hard, pull out, dig up and re-sow. Begin transplanting with the first good rains, and continue as fast as the rains and planters will allow, until the crop is set out. Be careful to fill in the misses from previous transplanting before starting on new fields; use the stoutest and best plants for filling in, and try to get the tobacco from any one field to grow and come to maturity as near at the same time as possible. Discontinue filling in when the field has been planted for several weeks and has made a good start to grow, as the later filled in plants will be choked out by the earlier ones, and will not come to maturity. Cultivate fields as soon as plants are established, to keep down weeds.

VETERINARY.

Early heavy rains might bring on horse-sickness before its usual time, but as a rule it need not be feared till the first rains are over in December.

WEATHER.

The rains should be commencing, if not already begun; occasionally they have delayed until December, and even later, before setting in properly. Between spells of wet weather lasting several days, fine dry periods occur, at first clear, but later cloudy and thundery, gradually gathering to burst in thunderstorms. The mornings are generally fine, and rain falls chiefly in the afternoon or evening. Heavy downpours are to be expected, and should be provided against beforehand by means of ditches and embankments, and by clearing water ways and furrows. In a normal season the rainfall varies from two-and-a-half to three inches in Matabeleland, and from three-and-a-half to four inches in Mashonaland generally, with the exception of the eastern border, where it amounts to five inches. Between the rain periods and prior to the commencement of the rains, severe heat is likely to be experienced.

December.

BEE-KEEPING.

With a normal season the first or main honey-flow of the year should now be over and the honey ready to be robbed. Before doing this, see that all or the main portion of the frames are capped and sealed, otherwise there will be trouble later on by fermentation. There is nothing on the market to equal the Porter bee-escape board to clear out the bees from the crate, but be sure and see that the board in question is placed the right side up under the crate; failure to do this (and in the hurry of the minute it can easily be so done) will result in the probable suffocation of the bees and the loss of the honey, to say nothing of the chances of robbing from any close-by hives. Replace the empty combs and frames as soon as possible on the hives, to be cleaned up and mended where necessary, and for future storage of more honey. During the very hot spells watch the hives and provide extra ventilation, by inserting small metal wedges between the crates, just wide enough to allow air in, but not a bee under any consideration. Keep all water tins under the hive-stand legs full of water, and see that water is available for the worker bee, which drinks a good deal. When extracting honey, do so in a bee-tight room or verandah, otherwise the operator may have a lot of trouble from other colonies, which quickly find where honey is. Always have one or more crates of shallow frames ready with foundation fixed to place on hives as the season may warrant; such will mean always something for the bees to work at, and during the last flow they may be invaluable to store any such catch crop of nectar, as from tobacco, etc., when the natural flora is finished.

CITRUS FRUITS.

This is a good month to plant citrus trees into their permanent positions. They should on no account be planted deeper than they stood in the nursery. Water each tree immediately after planting it to settle the soil, then loosen the surface when sufficiently dry to check weed growth and restrict evaporation; continue loosening the surface soil after each rain or watering. If good rains have fallen, disc the grove in two directions, then sow the cover crop and harrow also in two directions. If the grove is weedy it should receive a shallow ploughing in place of the discing. Then sow the seed and harrow the soil. All bearing trees must be kept well watered if the weather continues to remain dry. Trees that suffer for want of moisture while the young fruit crop is developing will be adversely affected, and the crop—if any—will be of inferior quality. Continue to rub off all water shoots or suckers which develop on the tree stems.

CROPS.

Keep the cultivators going, both on planted and unplanted lands, whenever weather conditions are favourable. Destroy the weeds while young and before they obtain a firm root-hold.

Continue planting maize, cotton, beans and ground-nuts as early as possible this month, followed by sunflowers, Sudan grass, manna, pumpkins and cattle melons. Linseed, cowpeas, teff grass, oats, Sunn hemp should be planted after the other crops are in. Ensilage crops may be sown at the end of the month. When harrowing maize after planting, this work should be done in the heat of the day when the young plants are flaccid and not easily broken. On lands not yet planted the crop of weeds should be kept down by disc-harrowing. It is a good plan to harrow or disc-harrow immediately before the planter, or alternatively to follow the planter with a light harrow. Treat seed oats for smut before sowing. Use one pint of formalin to 25 gallons of water and steep the bag of seed for

ten minutes. Earth up early planted potatoes. Keep a look out for the stalk-borer, and top or otherwise treat affected plants. New lands and old pastures may be broken, as circumstances permit, during December, January and early February, and again ploughed in from May to July. If they carry a heavy crop of grass it should be cut or burnt to enable good, clean ploughing to be done. Sweet potato slips should be planted early in this month. Do not fail to have in a few acres of this valuable crop.

DECIDUOUS FRUITS.

Cover crops may be planted when the rains commence, as recommended under citrus fruits. Summer pruning may be commenced this month. If all undesirable shoots are taken out of the trees, the remaining shoots will receive sufficient air and light to mature. Ripening fruit must be carefully harvested, graded and packed if satisfactory prices are to be secured. Do not gather any fruit when it is wet. Keep all recently planted trees in good condition; the first year's growth is the most important. If the undesired shoots are rubbed off when they first appear, the retained shoots will receive all the nourishment and the tree will then grow to a large size.

ENTOMOLOGICAL.

Maize.—The first half of this month appears to be the best period during which to plant maize for the avoidance of stalk borer attack—at least in the Salisbury district. Hoe out and remove volunteer maize plants before the new crop is up, as they are liable to be infested with borer, which tends to spread to surrounding plants. Red soils may be baited with chopped Napier fodder or other suitable greenstuff dipped in arsenite of soda 1 lb., cheapest sugar 8 lbs. or molasses 1 gallon, water 10 gallons, to destroy surface beetles, snout beetles and other insects which may affect the primary stand.

Tobacco.—The enemies of this crop are in general most active during December, whilst the crop is still in the early stages of growth.

For information regarding tobacco pests, see "Rhodesia Agricultural Journal," January, 1928, or Bulletin No. 665.

In general, poisoned baits may be used against surface beetles, grasshoppers, crickets and cutworms. Against surface beetles, arsenite of soda 1 lb. in 30 gallons of water used to moisten maize bran is a good bait. Against grasshoppers and crickets the addition of 8 lbs. sugar or 1 gallon molasses to each 1 lb. of arsenite of soda is recommended. Spray with arsenate of lead (powder) 1 lb. in 30 gallons of water against leaf-eating insects and as a protection against leaf miners and stem borer. Transplants may be dipped head downwards as far as the roots in the poison. Discard seedlings infested with stem borer and root gallworm.

Cutworms.—Keep ground around seed beds as free as possible from vegetation, to prevent female moths from laying eggs there. From the time the plants show foliage of the size of a sixpence they should be sprayed weekly with arsenate of lead (powder) 1 lb. to 30 gallons of water. This should prevent cutworms developing in the beds, as the young cutworms attack the leaves of the seedlings, and so ingest the poison.

House Flies.—With the coming of hot weather and the rains, house flies greatly increase, and should be kept out of dwelling houses by mosquito netting, or poisoned in the following way:—Dissolve 1 lb. of sodium arsenite in 10 gallons of water, and add about 10 lbs. of cheap sugar (2 gallons of treacle) or other sweet substance. The mixture should be sprayed upon branches of shrubs or trees, which may be hung up in convenient places where flies congregate. These insects are attracted to the bait, and are easily poisoned.

Mosquitoes, Stable Flies.—Destroy breeding places around homestead. Poison or trap adults.

Potatoes.—Ladybirds and caterpillars may be injurious to the foliage, and on sandy soils blue blister beetles sometimes cause damage. Spray with arsenate of lead (powder) 1 lb. to 25 gallons of water.

Kitchen Garden.—Marrows, etc., are commonly attacked by leaf-eating beetles. Spray with arsenate of lead (powder) 1 lb. in 25 gallons water, plus 8 lbs. cheapest sugar or 1 gallon molasses. Dusting lightly with pure arsenate of lead powder should give protection. Young plants of the cabbage family may be dusted with pure arsenate of lead powder or with such powder mixed with up to six or eight parts of finely sifted, thoroughly slaked lime as a protection against leaf-eating insects.

Fruit Trees.—The regular collection and destruction of fruit beetles may be necessary. Choice varieties of peaches, etc., may be netted as a protection against pests.

FLOWER GARDEN.

This month is generally showery, and constant stirring of the soil is, therefore, necessary to keep it loose. Seeds of perennials and annuals for February blooms may be sown. Transplanting should be done in the evening or on a cloudy day. Carnations should be kept free from dead wood, and climbers attended to.

VEGETABLE GARDEN.

All vegetable seeds may be planted. All advanced plants should be constantly cultivated. Potatoes should be ridged, and peas, beans and tomatoes staked. This is a good month for planting the main crop of potatoes.

FORESTRY.

Final preparations for planting should be made, including harrowing or pitting. Early plantings may be carried out if the season is a good one. Planting should be carried out on dull, rainy days, or failing such days, late in the afternoons. Great care should be exercised in planting out to avoid bending the tap root, and to set the trees in the ground at the same level as they were in the seed bed or tray. Late sowings of Cedrela toona seed may be made.

POULTRY.

The poultry keeper should take precautions whereby the wet weather will not affect his birds' health and their laying powers. All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs. Foodstuffs also must be kept absolutely dry.

Many birds will at present be moulting; these require special treatment to bring them through it quickly, and if possible keep them in lay during the period. A pamphlet on this can be obtained from the Poultry Expert, Department of Agriculture. This lack of attention to the birds during the moult is one of the causes of the scarcity of eggs at this season. There is no need for it if poultry keepers would only look after their birds properly.

Those who intend disposing of their turkeys for killing at Christmas must avoid cooping them up, as is done when fattening fowls, for they immediately mope and go off their food. Give them free range, and in addition to their usual evening feed of maize, during the first week of December give one of wheat or maize in the morning, and during the second and third weeks three meals a day, each one containing, in addition to wheat or maize, some crushed monkey nuts or sunflower seeds. Plenty of thick milk and chopped-up onions or onion tops should also be given.

Those who go in for ducks should feed well and get as many to marketable size as possible by Christmas, when they usually fetch good prices. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, maize meal, meat meal and milk, as

much as they will eat three times a day, i.e., they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 p.m., and the first meal is given at sunrise.

STOCK.

Cattle.—Feeding should be continued on the same lines as in November. Keep a close eye on any store bullocks that have been selected for fattening on grass.

Ranching cattle should not require any attention beyond dipping. Every effort should be made to have all the female stock in good condition for the breeding season.

Milch cows should be protected as much as possible from cold rains and hot sun. Yarding at night in a clean kraal provided with a simple lean-to shed well bedded up will be found to be very beneficial in seasons of protracted rainfall. The calf-pen should be kept clean, dry and sweet, and young calves will be better kept in during very hot or very wet weather.

Sheep.—Graze on the higher lands, keeping the kraals clean, dry and airy, and watch for ticks. Take out the rams at the end of the month.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

TOBACCO.

Continue preparation of land. The best results are obtained by transplanting on well prepared soil. Transplanting should be pushed on with as fast as transplants and climatic conditions will allow. As soon as plants begin to grow, go over the field and fill in all missing hills with strong selected plants, and then apply fertiliser to hasten growth and ensure early maturity. Cultivation should be commenced as soon as the plants start growing, especially on sandy soils. The crust caused by heavy rains should be pulverised through cultivation as soon as the surface soil is dry enough for tillage; this gives the young plants the benefit of the moisture stored in the soil. Do not neglect the late sown seed beds. Make every effort to finish transplanting before the end of the month, so that the crop will be harvested before dry, cool weather begins.

VETERINARY.

Occasional cases of horse-sickness may occur during this month. With the great increase in ticks, due to the heat and moisture, cases of redwater and gall-sickness may be expected, more especially amongst Colonial stock imported since the last rainy season. The cool weather which frequently follows the early rains is an excellent time for castrating calves and other animals.

WEATHER.

In Mashonaland the rainfall during this month varies from eight inches along the eastern border to six inches in the west. In Matabeleland it varies from five-and-a-half inches in the west to four-and-a-half inches in the south. Considerable divergencies from these normals may occur in individual seasons, but on the whole this month is the most regular in its behaviour. Very heavy downpours may be looked for, and it is well to be provided by drains and ditches against the effects of very heavy rain storms. A dry spell about Christmas time is a very frequent, though not invariable, event in Rhodesia. This partial drought may last only a fortnight, or may extend to six weeks, in the latter event often causing some anxiety regarding young crops, especially those not yet through the ground. The best means of meeting this condition of the weather is by frequent surface cultivation by harrow or horse hoe to preserve a loose soil mulch on the surface and prevent losses of soil moisture by evaporation.

SOUTHERN RHODESIA VETERINARY REPORT.

August. 1932.

AFRICAN COAST FEVER.

Rocklands Estate.—The process of removing the infected herds through temperature camps to clean veld was completed. Mortality during the month from Coast Fever, 3 head.

Laughing Waters.—The removal of the infected herd to clean veld was completed. No cases of Coast Fever occurred.

FOOT AND MOUTH DISEASE.

Gwelo Veterinary District.

In the Gwelo district a fresh outbreak occurred on farm Sonambula No. 6. The infected and several adjoining herds were inoculated.

Umvuma Veterinary District.

At the Central Estates the results of the inoculation were most satisfactory.

Bulawayo Veterinary District.

Insiza District.—The cattle moved from the Mbondu dipping tank area to the Siwazi area for inoculation have completely recovered and will be returned to their kraals about the middle of September.

Belingwe District.—The disease in this district has cleared up completely and all cordons have been released.

Gwanda District.—The cattle inoculated on Olympus Block recovered completely and at the end of July were returned to their original grazing grounds.

A fresh infection was found on the 3rd in Magayas dipping tank area on Railway Block No. 2 and on the 5th was also found at Dubanes tank area which includes farms extending northwards to the West Nicholson-Thornwood Block Road. All the cattle involved were concentrated and inoculated. As a further precaution a cattle free belt was established between the Mtshibizini River and the Gwanda-Sengazbaan road to the Store on the Tuli River and a cordon placed completely around this belt. All cattle on Oakley Block and Doddiburn Ranch were also inoculated.

A further outbreak was discovered on the farm Deneys on the 28th. It appears that the infection was carried to this farm by certain animals which had strayed from it and probably contracted the disease at Railway Block No. 2. The infected herd was moved to Oakley Block and 529 head of immune cattle, also on Deneys, were moved to Cleveland Block.

The total number of cattle inoculated during the month was 28,819.

TRYPANOSOMIASIS.

Six deaths reported from the eastern border, Melsetter district, and several cases in the Darwin district.

MYIASIS (SCREW WORM IN CATTLE).

Reports in several districts.

SCAB.

One flock placed under licence in Melsetter district.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate: Bulls 2, horses 5, sheep 1,016, goats 112, pigs 24.

EXPORTATIONS.

Nil.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA WEATHER BUREAU.

SEPTEMBER, 1932.

Pressure.—The mean pressure for the month was generally very low. Pressure conditions were normal early in the month, but deep lows appeared in the last decade and unusually low pressure was recorded.

Temperature.—Mean monthly temperature was everywhere well above normal.

Rainfall.—Light showers occurred at intervals on the Eastern Border. In conjunction with the low pressure, thunderstorms commenced in the N.E. on the 25th and 26th. Scattered showers were reported on the 27th and 28th, and on the 29th and 30th thunderstorms occurred in the S.W. and South.

SEPTEMBER, 1932.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen ° F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet).
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal.	No. of Days.	
Bulawayo ...	870.1	870.9	93	44	83.7	54.6	69.2	67.5	69.5	54.5	36	41	2.5	0.27	0.2	4	4,436
Gwelo	864.2	...	92	40	82.9	55.6	69 3	67.4	68.2	55.6	44	45	2.5	0.52	0.2	2	4,632
Riverbank ...	...	...	100	41	90.6	56.9	73.8	71.0	69.0	54.3	36	42	...	0.37	0.2	1	4,100
Essexvale ...	...	...	102	34	91.0	53.5	72.3	69.0	66.3	55.2	48	46	...	0.11	0.2	1	3,828
Gwanda ...	907.3	...	97	39	87.2	57.7	72.5	...	72.2	57.0	37	45	2.1	0.38	0,2	1	3,235
Mazunga ...	949.6	951.7	102	45	90.0	56.9	73.5	71.8	72.5	62.0	55	55	2.8	...	0.2	...	1,970
Nuanetsi ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.2	...	1,630
Between Rivers	...	...	95	40	87.8	54.2	71.0	...	70.5	56.6	41	45	0.7	...	0.4	...	3,970
Enkeldoorn ...	859.3	...	92	44	81.7	55.0	68.4	67.0	68.9	56.7	45	47	2.0	0.16	0.1	1	4,720
Gatooma ...	...	...	97	47	87.7	56.5	72.1	71.0	69.5	56.4	43	45	3.8	0.01	0.1	1	3,850
Miami	880.2	...	91	46	83.5	57.2	70.4	...	71.6	58.1	43	48	0.2	...	...	...	4,090
Salisbury ...	856.4	857.1	90	44	81.1	56.3	68.7	66.6	68.3	55.8	45	47	1.4	...	0.3	...	4,890
Sinoia ...	...	...	95	41	86.8	53.7	70.3	...	72.6	58.4	42	48	0.6	0.04	0.3	1	3,804
Sipolilo... ...	...	...	92	50	83.3	61.0	72.2	...	72.8	57.8	38	46	0.9	...	0.1	...	3,900
Mtoko	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4,210
Shamva ...	...	...	96	45	87.2	57.6	72.4	...	72.1	59.2	46	50	1.6	...	0.1	...	3,170
Angus Ranch ...	...	...	101	52	88.9	62.4	75.7	70.9	72.6	60.9	50	53	...	...	0.1	...	2,300
Craigendoran ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
New Year's Gift	...	...	101	50	86.5	58.4	72.5	...	69.7	59.8	56	53	...	...	0.3	...	2,700
Nyamasanga ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5,080
Riverdene North	...	...	96	30	86.4	51.2	68 8	...	66.6	57.4	57	51	...	0.09	0 3	1	3,700
Stapleford ...	...	...	81	33	69.8	48.8	59.3	...	64.1	55.7	58	49	1.8	0.03	0.4	2	5,450
Umtali	894.7	895 9	94	45	82.1	56.6	69.4	67.4	69.9	59.9	55	53	2.1	0.04	0.5	1	3,677
Victoria ...	897.1	898.1	97	42	84.8	54.6	69 7	66.1	69.2	...	...	...	2.5	...	0.2	...	3,570
Melsetter ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.5	...	5,060
Mount Selinda	...	...	89	47	80.3	55.3	67.8	...	66.9	58.3	59	52	2.5	0.04	1.1	1	3,520
Manchester ...	...	...	85	42	73.5	51.6	62 6	...	55.2	51.7	79	48	...	0.06	...	2	...

DEPARTMENTAL BULLETINS.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.

No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.

No. 429. Propagation of Kudzu Vine, by H. C. Arnold.

No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.

No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.

No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.

No. 550. Onion Growing under Irrigation, by C. Mainwaring.

No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.

No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.

No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.

No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.

No. 630. The Storage of Seed Potatoes, by H. C. Arnold.

No. 634. Barley, by P. V. Samuels.

No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.

No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.

No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.

No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.

No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.

No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.

No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.

No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.

No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.

No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.

No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

No. 759. Witch Weed (Striga Lutea): Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.

No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.

No. 781. Agricultural Costings at the Gwebi Farm—Maize and Green Manuring, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

No. 787. Agricultural Costings at the Gwebi Farm—Ground Nuts and Maize and Beans for Silage, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 793. Agricultural Costings on the Gwebi Farm, by H. G. Mundy, Dip.Agric., Chief Agriculturist.

No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.

No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.

No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.

No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.

No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.

No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.

No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.

No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.

No. 833. Subterreanean Clover on the Sand Veld as Feed for Poultry in the Winter, by S. D. Timson, M.C., Dip.Agric.(Wye).
No. 836. The Potato, by S. D. Timson, M.C., Dip.Agric.(Wye).
No. 837. Veld Grass Silage—A Feature in Rhodesian Pasture Management, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief, Division of Plant Industry.
No. 838. Witch Weed—Progress Report and a Warning, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 841. Poisonous or Suspected Poisonous Plants of Southern Rhodesia: Tulp Poisoning of Cattle, by Sydney M. Stent, Senior Botanist, and D. A. Lawrence, B.V.Sc., Veterinary Research Officer.
No. 855. Pigeon-hole Method of Stacking Maize, by Division of Plant Industry.
No. 859. Twenty-one Years of Plant Introduction, by Major Mundy, Chief, Division of Plant Industry.

REPORTS ON CROP EXPERIMENTS.

No. 608. Annual Report of Experiments, 1924-25, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.
No. 631. Bulawayo Experiment Station: Annual Report for Year 1925-26, by H. W. Hilliard.
No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.
No. 675. Bulawayo Experiment Station—Annual Report for Year 1926-27, by D. E. McLoughlin.
No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.
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EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Important. Export of Tobacco Licences, 1933.—The attention of all tobacco growers is drawn to Government Notice No. 162 of 1932 in connection with the licences required for the export of tobacco under the Tobacco Pest Suppression Act, 1931.

In 1932 application had to be made on or before the 31st March, but in respect of next year's export applications, in writing, for licences for 1933 must be submitted to the Department of Agriculture on or before the 31st December, 1932.

No charge is made for the licences provided application is made before the date specified. Should, however, an application be received later, the Minister may grant such licence provided the applicant undertakes to pay any expenses which may be incurred by reason of the irregularity of such application.

Wheat Growers' Exhibition, 1932.—The Third Annual Exhibition of wheat and other cereals will be held at Enkeldoorn on the 9th December. It is anticipated that the Honourable the Minister of Mines and Agriculture will open the Exhibition at 10.30 a.m.

As in previous years the Exhibition is being organised by a representative committee under the chairmanship of the local Magistrate, with the assistance of the recently formed Wheat Growers' Association.

There are numerous classes open for competition and valuable prizes are being offered by firms dealing in agricultural machinery, fertilisers, etc., throughout the Colony, and the judging will be performed by officers of the Agricultural Department.

Cotton.—While, in these days of low prices, little is heard about cotton, it is felt that this crop will make headway as soon as there are any indications of an advance in prices.

A number of growers are now finding that with lower costs of production, there is a small profit to be made from cotton where good crops are obtainable.

There is no doubt that in the U/4 derivatives which have been bred up at Gatooma, we are in possession of cottons admirably suited to the country. But for the incidence of bollworms and stainers, yields would be heavier and better than they are at present, and even at to-day's prices, would give a fair return. As it is, a number of farmers are making a small profit from cotton growing, and it is hoped that they will continue to persevere with it, if only for the sake of keeping up a supply of seed. For those areas which are distantly situated from the railway where it has been found that good cotton crops can be grown, it might be advisable to consider this crop as an alternative to maize. Cotton has the advantage of not requiring applications of artificial fertiliser, and it does not exhaust the soil.

The latest strains which have been produced at the Cotton Breeding Station give promise of heavier yields. These are being tried out in the districts this year on small

plots, but will not be available for general distribution until they have demonstrated their adaptability to the respective areas where their behaviour is being observed.

The Feeding of Dairy Cows.—An article on the feeding of dairy cows appears in this issue.

The problem before dairy farmers in the Colony to-day is to reduce the cost of production of dairy products to world levels. As far as the farmer is concerned, this can best be achieved by increasing the output of milk per cow and per acre.

Among other things, under our conditions, this calls for the maximum use of grass, the feeding of a properly balanced supplementary grain ration and the weeding out of uneconomic producers.

Recommendations on these matters are made in this article, which should be of considerable value to both the dairy farmer and the ordinary mixed farmer.

Table Poultry.—It is probable that the interest in poultry has shown greater increase during the last 12 years than that in any other branch of farming.

Up to the present, however, the production of eggs for sale has been the chief object and the production of suitable table poultry has been almost entirely neglected.

According to the latest statistics, there are considerably more than ¼ million fowls on the farms in the Colony, and there are probably almost as many on the plots near towns.

The conditions are particularly favourable for the fattening of table poultry on economic lines, and the article which appears in this issue will be welcomed by all who are interested in poultry.

It is not possible in the scope of a single article to give all the particulars that may be required, but any points not dealt with in the article can be further explained if enquiries are addressed to the Chief Poultry Officer.

Salt for Stock.—An interesting article by W. Thomson, of the Rowett Institute, appeared in the April number of the *Scottish Journal of Agriculture.*

The results of an interesting series of experiments are recorded, which indicate that in the majority of cases at least half the annual consumption of salt by cows occurred during the eighteen weeks round about the date of calving.

It is stated that no data are available regarding the amount of salt required by sheep, pigs and poultry. Indoor-fed sheep should always have access to salt, which they will freely lick without harm to themselves. The belief that salt is "poison" to pigs is difficult to understand when it is realised that pigs fed regularly on kitchen refuse, hotel swill, etc., would obviously be having their food seasoned with salt to the human taste. In present-day practice pigs are regularly fed rations containing 1 to 2 per cent. of salt, and those fed on large amounts of potatoes or maize will readily lick salt placed in their pens. In a test to determine whether salt had toxic effects, increasing amounts up to 2.5 ounces per head daily were fed to pigs without any harmful results, the animals gaining normally in weight. The danger only arises, apparently, when pigs which have not been accustomed to salt are suddenly put on a diet containing a relatively high percentage of it. Results of recent poultry experiments show that an addition of 0.5 per cent. of salt to a ration of cereals and soya-bean meal increased the growth-rate of chickens by 24 per cent., and decreased the mortality by about 17 per cent. The pullets receiving salt looked healthier and laid earlier than those not receiving the supplement.

One concludes from this study that the maintenance of perfect health among indoor-fed dairy cows is dependent on their having access to considerable amounts of salt, this being especially so round about calving time. Probably the most convenient way to administer salt is in the form of licks, and by enriching the concentrates to the extent of 2 or 3 per cent. of salt. No harm results from giving cattle, sheep and pigs free access to salt at all times. These conclusions are on the assumption that water is also available *ad libitum.*

"Grasslands of South Africa": This is the title given to the first report which has just appeared of the Grassland Research Committee, which comprises officers of the University of Pretoria and the African Explosives and Industries, Ltd.

The Committee is to be congratulated upon the thorough survey of research abroad, the grassland situation in South Africa and the complete review of the problems still awaiting solution.

An excellent bibliography is included, which should be of very great importance to anyone interested in this subject.

The section of perhaps the greatest interest is that dealing with erosion and the run-off of storm water. On a series of 10 carefully-planned plots on the University Farm it was found that during the rainy season 31.2 per cent. of the total rainfall ran off a plot which was kept bare. Only one per cent. was lost from a similar sized plot on which the natural veld grass had been left. The slope in both cases was slightly less than 4 feet in 100.

The comparative figures for a very heavy downpour, when 1.68 inches fell in 20 minutes, were 70 per cent. as compared with 1.4 per cent. It would appear, moreover, that the run-off is comparatively high on closely grazed veld, especially during heavy rains, and the importance of maintaining the natural grass cover on pastures as a means of controlling soil erosion cannot be stressed too much.

St. Dunstan's Report.—The 17th Annual Report of St. Dunstan's has just been published. It tells honestly and without sentiment of the work which St. Dunstan's has done, and is doing, for men who lost their sight in the service of their country. It deals in practical matters, with accomplished facts, it give detailed records of the daily lives of some of these men. There is a balance sheet and analysis of accounts at the end of the book. And that is all. What more need there be?

Those who think that the work of St. Dunstan's is over should read this report. They will find there details of the

Brighton Establishment, which is now a training centre, a holiday and convalescent annexe, and a home for those who, in addition to being blinded, are permanent invalids as a result of their war service.

There is the Blinded Soldiers' Children's Fund, which makes weekly allowances in respect of no fewer than 2,080 children who are not eligible for Government grants.

They will read, too, in this report of the many branches of St. Dunstan's work throughout the Empire and our Dominions.

Copies of the Report will gladly be sent on application to the Headquarters, Inner Circle, Regent's Park, London, N.W.1.

Customs Documents—Export Unmanufactured Tobacco. —Attention is directed to the fact that, as from 1st January, 1933, Customs documents relative to the export of unmanufactured tobacco must indicate clearly the class of tobacco in addition to the weight of tobacco in each class.

There will be four classes of tobacco specified under the following headings:—

"Flue Cured,"

"Dark Fire Cured,"

"Other Types,"

"Turkish."

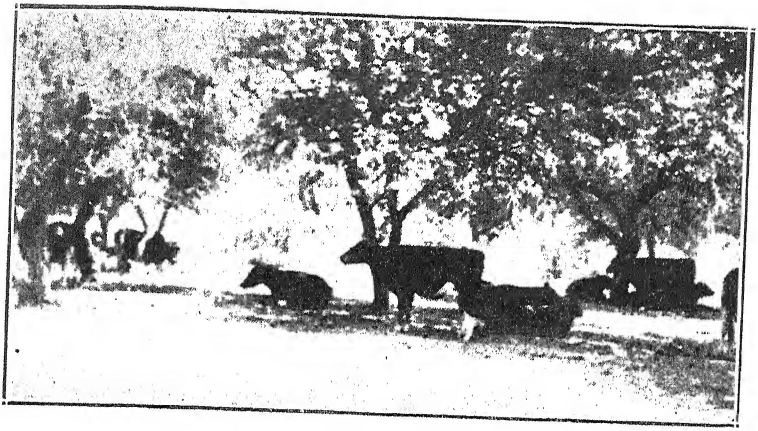


Fig. 1.—Shade is appreciated.

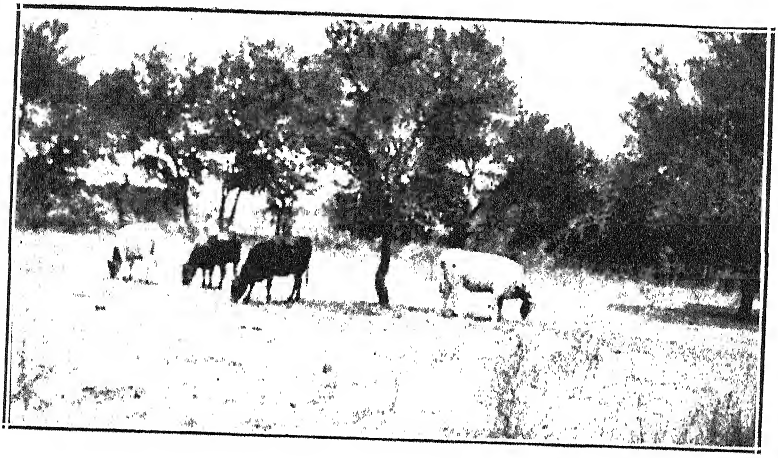


Fig. 2. Potential producers.

SOME GENERAL OBSERVATIONS ON THE FEEDING OF DAIRY COWS ON A MIXED STOCK FARM.

By A. E. Romyn, Senior Animal Husbandry Officer.

1. Summer Feeding.—As far as the general farmer is concerned summer milk production has many advantages over winter production. The cows, for instance, generally calve with more regularity in the spring or summer months than in the winter, and there is less trouble in parturition. On the basis of present prices summer dairying is usually more profitable than winter dairying, and though it may be doubted whether a sound dairy industry can be built up on summer production alone, for the time being the tendency to produce as much cream as possible in the summer is justified by results.

Profitable summer production is largely bound up with the question of efficient use of the natural grazing, and the better use the summer dairyman can make of grass, the lower usually are his production costs.

The young growing grass is more valuable than matured grass, and one of his chief problems in feeding, therefore, is to conserve the "youth" of spring grass as long as possible. Experience has shown that this object can be achieved in a certain measure by keeping the grass closely grazed and so preventing it from maturing. If suitable paddocks are available a proper system of rotational grazing can be developed, involving the use of two or more camps, which are grazed in turn. The milking cows should get the first grazing in each paddock and be followed up by the dry stock and young cattle. The bulk of the grass should never be allowed to get more than a few inches high, and after each camp is grazed down the coarse uneaten

grass should be removed with a mower as far as possible. We have still to learn the best long-time system of pasture management for our conditions but probably, as time goes on, it will be necessary to fertilise or rest these camps periodically to maintain the stand of grass.

Long treks, especially in hot weather, are fatal to high milk yields, and a system of camping which enables proper use to be made of the grazing and keeps the cows at a convenient distance from the milking place should be developed on all farms where dairying is carried on. Fencing is in some cases as important a factor in the milk yields as good bulls.

It is difficult to exaggerate the value of any factor which makes for the greater comfort of the cows, especially where the better grade of dairy cattle is concerned, and in applying any system of close grazing care must be taken to see that the milk cows are not forced to graze down unpalatable grass or to consume short, dry vegetation late in the season when the active growth of the grass has stopped, or the milk yield will suffer.

Another important point is the provision of ample clean water in troughs, and good shelter from sun in the summer and cold winds in the winter months.

The natural pastures in some countries, and cultivated pastures in some parts of the Union of South Africa, are sufficiently nutritious to maintain a high milk yield without the use of supplementary concentrates. On Kikuyu pasture in Natal, for instance, a yield of 1,000 gallons of milk per acre has been reported, but so far the practical experience of Rhodesian farmers has been that, except in very favourable grazing areas, it is not usually possible to sustain a yield of much over one gallon per diem for any length of time unless supplementary feeding is practised. Possibly the establishment of suitable permanent pastures may make supplementary feeding unnecessary as the dairy industry becomes more specialised but, under present veld conditions, a fairly liberal scale of feeding has been found necessary to maintain a good flow of milk.

The character of this supplementary feeding should be determined by a number of factors, the chief of which are:

The nature of the pasture, the season, the value of product sold, the price of grain and the condition of the cows. Any restrictions or deficiencies in the feeding will naturally have more serious effects with good than with poor milkers.

Unfortunately, very little properly controlled work has been carried out under our conditions to determine the most economic ration or plane of feeding for cows on natural veld, and experimental work of this nature is urgently required. On the basis of our present information of the composition of "ordinary veld," a general feeding schedule for dairy cows on grass is given in the following table. It should serve as a useful guide but is *not* intended as a fixed rule to be rigidly adhered to.

Summer Feeding Schedule.

		Amount of each feed in 100 lbs. of concentrate mixture.						Amount of each ration required per day.	
Months of year.	No. of ration.	Maize meal.	Sunflower-head meal.	Groundnut meal (whole plant).	Groundnut meal (kernels only).	Cotton seed or undecorticated cotton cake.	Decorticated groundnut cake.	Production of cow, in gallons, per day.	Amount of grain ration, lbs.
October ...	1	100*						1	Nil
	2	75	25					2	2
November...	3	75		25				3	5
	4	90			10				
December...	5	90				10†		4	9
January ...	1	75					25	1	Nil
	2	60	20				20	2	3
February ...	3	60		20			20	3	6
	4	65			20		15		
	5	60				20	20	4	10
March ...	1	70					30	1	2
	2	50	25				25	2	5
April ...	3	50		25			25	3	8
	4	60			20		20	4	12
	5	50				25	25		

* Not generally suitable where more than 5 lbs. per day has to be fed.

† Cotton seed alone or crushed cotton seed mixed with an equal proportion of maize meal is a satisfactory feed for dairy cows in the earlier part of the season and can be used instead of the mixture given. The cows should be accustomed gradually to the seed. Quantities up to 5 lbs. of cotton seed per day can usually be fed with safety.

The proportion of purchased feed, groundnut or cotton cake in these rations is considerable. The most practical way to reduce these purchases, without reducing the milk yield, is to improve the quality of the pasture so that it does not fall below, say, the January standard until much later in the season. As indicated previously, this object may be achieved by better pasture management or by the establishment of improved pastures. The resultant saving on bought feed and of concentrates is a cogent argument for the improvement of pastures.

The progressive decrease in the protein content and the feeding value of the ordinary grazing as it matures is compensated for in the rations suggested by the progressive increase in the protein content and the amount of the grain ration. Thus, a cow giving three gallons of milk in December might receive 5 lbs. of, say, ration 3, which consists of maize meal 75 lbs., groundnut meal (whole plant) 25 lbs.; whereas a similar cow producing three gallons of milk in March, would have to receive 8 lbs. of a modified grain ration No. 3, which contains maize meal 50 lbs., groundnut meal (whole plant) 25 lbs., groundnut cake 25 lbs. to maintain a similar production of milk.

During the latter part of April and the early part of May, such succulent feeds as green maize, sweet potato tops and silage, saved from the previous season, are of great value in maintaining the milk yield when the grass becomes short, dry, or unpalatable.

In the case of cows which produce normally over three gallons of milk per day or during dry seasons, it may be advisable to change over to the "increased mixtures" a month earlier than is recommended in the table. It is very difficult to bring about a recovery once there has been a drop in the milk yield, and it is very unwise to postpone supplementary feeding, especially near the commencement of the winter, until the stock show a distinct drop in milk yield or condition. The condition of the cows and their production of milk should, therefore, be watched closely at this time to see when change in feeding is necessary.

Bone meal and salt should be added to the ration of dairy cows; each cow in milk should be allowed 3 to 6 oz.

of bone meal and 1 oz. of salt per day. These amounts are given most conveniently by mixing the bone meal and salt in suitable proportions with the grain ration. Failure to provide sufficient minerals will result in a drop in the milk yield, irregularity in breeding and loss of condition.

The amount of grain fed to the cows should be based closely on their milk production. Supplementary feeding cannot be carried out on the most economic lines unless the production of each cow is known and its feed regulated accordingly. The milk scale is a necessary adjunct to scientific feeding and, where the farmer does not record his cows under one of the official or semi-official schemes, he should take steps to keep adequate private records to enable him to see what each cow is doing. To do this it is necessary to hand-rear all the calves.

2. Winter Feeding.—The cream producers who make the most profit out of winter dairying are usually those with cows of high production, which normally milk over the summer into the winter season, or those who are raising breeding stock for sale and need a good record to sell their heifers to advantage. Provision should be made, however, on practically all dairy farms for some supplementary feeding in the winter.

It is generally necessary to adopt a full winter feeding schedule in May or June to maintain the condition of the cows intended for production during the winter, and, to avoid feeding temporarily unprofitable cows, it is usually advisable at this time or earlier, to dry off any cows far gone in their lactation, only keeping on those milking over, say, 1½ to 2 gallons per day, depending on circumstances. The milking of cows suckling calves should also be stopped at this time. Feeding for production in the winter months is expensive on account of the lack of sources of cheap farm protein. Protein feeds commonly available on the farm at this time are groundnut meal (either the whole plant or the kernels only ground into meal), cotton-seed, sunflower meal, cowpea, dolichos or velvet bean hay and mixed silage—maize planted with some leguminous crop such as dolichos or velvet beans. Recent work indicates that grass silage

properly made may turn out a satisfactory winter succulent with a fair protein content, but more experience in the making of grass silage under our conditions is necessary before it can be safely adopted as a general feed. The meals and hays just referred to, on account of their low yield, are comparatively expensive sources of protein, and at present market values compare unfavourably with the bought protein concentrates such as decorticated groundnut cake or ordinary cotton cake. The production of sunflowers and the leguminous crops just mentioned fits, however, into the general farming system and carries certain supplementary benefits which seem to make their cultivation on a limited scale a wise policy, and each individual farmer should decide for himself whether it is better to increase his acreage of these crops or to buy cake.

It is generally necessary to purchase a protein concentrate to sustain a milk yield of over two gallons under our conditions and, though in other countries there is a wide range of these concentrates to choose from, under local conditions the choice during the winter months is practically limited to groundnut cake. Wheaten bran is a valuable feed but too expensive for general use. Both cotton seed and undecorticated cotton cake are too low in protein to balance a ration for high producers unless a palatable legume hay is available, which is all too seldom. Cowpea grain when added to the grain mixture in fairly large proportions has given indifferent results. Sunflower meal, if used in the grain mixture in a larger proportion than 25 per cent. by weight of the total mixture, makes a ration which is too bulky for high producing cows. Dolichos beans and velvet beans are somewhat indigestible and unpalatable, and cannot be used in sufficiently large proportions to build up the protein content of the ration to the level required. The choice, therefore, narrows down to groundnut cake in the winter and groundnut cake or cotton cake in the summer months. This concentration on more or less one feed has certain economic disadvantages, and dairy farmers should keep in close touch with the groundnut and cotton cake market to ensure that provision is made for reliable supplies to the industry at a reasonable cost.

A primary consideration in making up a feeding schedule for dairy cows in the winter months is the availability or otherwise of a legume hay.

Where a palatable legume hay is available in sufficient quantity, the foundation of the grain mixture should be 300 lbs. of maize meal to 100 lbs. of groundnut cake. When such a hay is not available, the proportion of cake should be increased to 150 lbs.

Other feeds, such as sunflower meal, groundnut meal (whole plant), cowpea meal, wheaten bran, velvet bean meal (pods and seeds ground), should be added to this foundation either singly or in combination to make up not more than 25 per cent. of the total concentrate ration by weight. They add to the palatability of the ration and by increasing the number of component feeds, tend to produce a better balanced mixture. General experience up to the present does not favour the addition of a greater proportion than 25 per cent. by weight of these feeds, but each farmer should work out for himself whether it is a better financial policy to buy more "cake" for his cows or to be content with a lesser milk yield.

Three to four pounds of the foregoing mixture per gallon of milk produced is generally taken to be the optimum rate of feeding. The higher figure should be used where the milk is of rich quality or the roughages are of poor quality. For cows giving less than two gallons of milk per diem, or where it is desired not to force the cows for maximum production, it may be profitable to follow a lower scale of feeding. Under our conditions, however, a lower plane than the one recommended frequently results in the early drying off of the cows. Abrupt changes in the character of the ration should be avoided, as they tend to upset the cow.

It is usually not necessary under our conditions to limit the amount of roughages fed to the cows, or to prevent them from picking up what grazing is available in the winter months. A normal allowance of hay is 7-10 lbs. per head per day. If this hay is a legume, the proportion of "cake" in the concentrate ration can be reduced as already indicated.

Twenty-five to thirty pounds of silage, depending on the size of the cow and the amount of hay fed, or a proportionately greater weight of majordas or pumpkins is a normal allowance of succulent feed in addition to the hay. These succulent feeds are of great value in maintaining the thrift of the cows during the dry months of the year.

Where a suitable vlei or a land under irrigation is available, valuable supplementary grazing can often be obtained from the green grass or on green oats or barley; and the preliminary results obtained by this Department from the establishment of winter grass pastures on vlei soils hold out promise that pastures of this nature may help a great deal in the solution of the winter feed problem in Mashonaland. A small acreage of lucerne is often an invaluable asset.

Finally, the mixed dairy farm is incomplete without pigs. In specialised dairying countries it is often stated that the net profit on the dairy business is the separated milk which is fed to the pigs. Separated milk, butter milk and, to a lesser extent, whey are very valuable feeds for pigs, and dairy farmers who manage their pigs properly find that the pig substantially increases their financial return per gallon of milk.

Under present conditions a dairy farmer should plan to keep one breeding sow to every four to six cows in his herd.

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

IMPROVED PASTURES AND GRAZING EXPERIMENTS.

By The Division of Plant Industry.

After a number of years of preliminary trial with numerous hay and pasture grasses—both indigenous and exotic—it was decided during 1929 to establish on the Agricultural Experiment Station, Salisbury, small paddocks of Woolly Finger grass (*Digitaria pentzii*) and Hunyani grass (*Chloris gayana* var.), these appearing two of the most promising.

Hunyani grass is a native of Rhodesia and in many respects is much like Rhodes grass but produces surface runners very much more luxuriantly. It does not seed as freely as Rhodes grass and is difficult to establish by this means.

The land selected for the paddocks had been under cultivation for eighteen years, during which time it had been cropped chiefly to maize. The section on which Woolly Finger grass was planted had received a dressing of 12 tons per acre of farm manure the previous season, and a further 200 lbs. per acre of bone and superphosphate was broadcasted before the grass roots were planted. The land on which the Hunyani grass was established had had no manure or fertiliser for several years, and on this section bone and superphosphate was applied at the rate of 400 lbs. per acre prior to planting of the grass.

Each paddock was two-thirds of an acre in extent and both were planted on 29th November, 1929, the grass roots being spaced 40 inches x 18 inches apart. As a result of favourable weather conditions, over 90 per cent. of the transplants became established and at the end of the season the Hunyani grass had practically covered the entire ground, while the Woolly Finger grass had covered about three-quarters of the space between the rows.

Hunyani grass was grazed by cattle during the following winter, but Woolly Finger grass not being then considered ready for grazing, the summer growth was cut and removed from the field.

Treatment and Results, 1930-31.—With the advent of warm weather in the spring of 1930, growth commenced on the Woolly Finger grass paddock, and by mid-December the runners had completely covered the bare patches which had not been filled during the previous season. Hunyani grass did not commence its spring growth as early as Woolly Finger and for that reason it could not be grazed until two or three weeks later than the latter. At intervals during the summer and following months, several head of cattle were intermittently grazed on the pastures as circumstances justified, and in the tabulation below are shown the number of *ox-grazing days which each paddock provided each month.

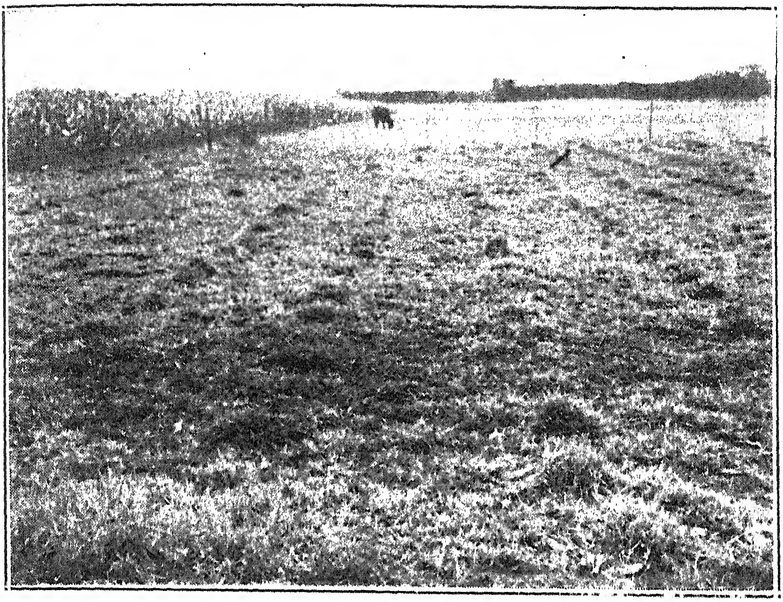
Kind of grass.	Dec.	Jan.	Feb.	Mar.	July.	Aug.	Total for ⅔ acre.	Equivalent for 1 acre.
Woolly Finger grass	30	12	49	36	40	—	167	250.5
Hunyani grass	—	54	101	—	—	40	195	292.5

During the period December to March, the cattle received no supplementary food, and the results indicate that under the conditions pertaining to this experiment the carrying capacity of these grasses during the summer months was from 1.5 to 2 head of adult cattle per acre. An even longer period of grazing would probably have been provided if the seasonal rains had continued as they normally do, until the end of March.

During October, 1931, the paddocks received superphosphate (19 per cent.) at the rate of 200 lbs. per acre, and later, one-half of each received a dressing of 100 lbs. per acre of sulphate of ammonia. It may here be mentioned that, contrary to expectations, the application of nitrogen exerted no observable influence on growth or palatability.

About this time it was to be seen that large patches of the Hunyani grass had apparently died out over about

* By ox-grazing days is meant the number of days of grazing which would have been provided for one ox, or alternatively, the number of oxen for which the paddock would have provided grazing for one day.

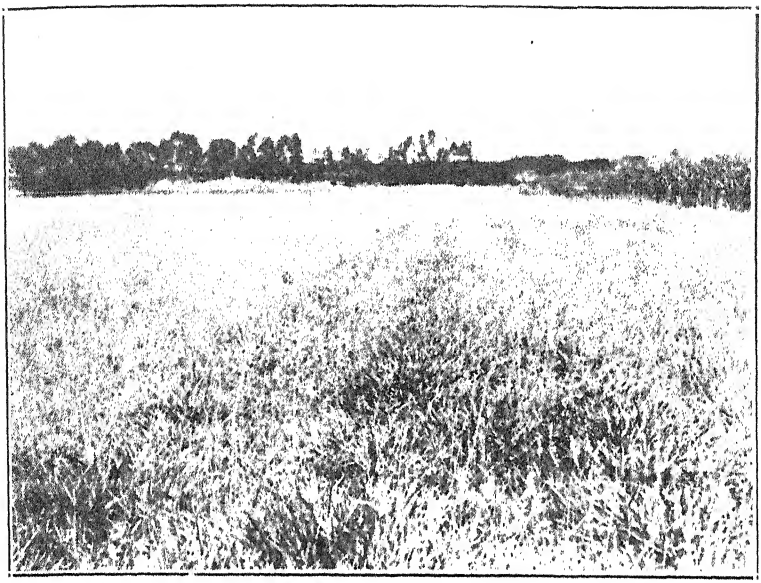


Woolly Finger grass after being fairly closely grazed.

Hunyani grass. Paddock heavily grazed.

Gonya grass (*Urochloa trichopus*). This is a finer-leaved grass than *Urochloa bolbodes*.

Gonya grass (*Urochloa bolbodes*) in full growth.



Creeping False Paspalum (*Brachiaria dictyoneura*) in flower.

Purple-top Buffel grass (*Panicum maximum*) in full flower in background.

one-quarter of the paddock. No definite cause for this could be ascertained and it can only be presumed that termites were mainly responsible. However, by means of its rapidly-spreading surface runners the grass re-covered the bare patches within a few weeks of the commencement of the rains. Woolly Finger grass did not suffer any serious ill-effects from either termites or the winter drought.

Results during 1931-32.—It was decided from this time onward to conduct the experiment as an intensive grazing trial to test the respective carrying capacity of the two grasses, and in consequence on the 30th December, 1931, one large adult ox was placed in each paddock and kept there continuously without other food. Both animals gained weight rapidly, and after 2 to 3 months had attained as high condition as is usually associated with good, grass-fed slaughter cattle. This condition was maintained for several weeks, but towards the end of May the beasts began to lose weight. During July the ox on the Hunyani grass repeatedly broke through the fence to the Woolly Finger grass paddock, thus indicating that it found that grass more abundant and palatable than its own. Owing to the absence of further grazing, this ox was removed from its paddock on the 23rd July, and, although as yet it had shown no sign of discontent, the ox on the Woolly Finger grass was likewise removed six days later, as it was feared that a longer period of grazing might injure the grass and delay its recovery the following season. This animal had been solely maintained without any supplementary food for 7 months on two-thirds of an acre (equal to 318 days for 1 acre) of Woolly Finger grass.

Although it is not possible to draw definite conclusions from results obtained from single plots and single animals, the experiment seems to indicate that the carrying capacity of Woolly Finger grass is somewhat greater than that of Hunyani grass and that it is also more palatable during the winter months, a characteristic which enhances its value. It would, therefore, appear that when the provision of pasturage is the main object, Woolly Finger grass may be the more desirable since it grows steadily and persistently over a longer period and its short, dense, leafy herbage is

nutritious even when dry. On the other hand, if it is desired to preserve the summer growth of grass in the form of hay or silage, Hunyani grass may be preferred, its upright habit of growth providing a good and weighty cut for either purpose. It may be mentioned at this stage that the roots of Hunyani grass do not travel well or transplant as readily as those of most other grasses of similar type, and before extensive planting can be contemplated, a nursery of Hunyani grass should be established on the farm.

Extension of Grazing Trials.—A further series of two-thirds of an acre paddocks were laid down in November, 1931, to (a) Creeping false paspalum (*Brachiaria dictyoneura*), and (b) Reed Timothy (*Setaria phragmitoides*) underplanted with Woolly Finger, Hunyani grass, and creeping false paspalum. Two other paddocks were established by means of seed to Purple-top buffel grass (*Panicum maximum*) and Gonya grass (*Urochloa trichopus*) half plot, and (*Urochloa bulbodes*) half plot.

The area chosen for these extensions had been under cultivation for some twenty years and being somewhat reduced in fertility it was deemed advisable to fertilise the whole with 200 lbs. per acre of superphosphate before establishing the grasses.

Favourable climatic conditions resulted in a very good cover being secured from the species established from root-divisions, and being sufficiently well established to permit of grazing, a large adult ox was placed on each of the (a) and (b) paddocks referred to above on the 8th June, 1932, with a view to ascertaining their respective carrying capacities during winter.

In August, however, an unusually heavy fall of rain, totalling nearly two inches, enabled the grasses to make unusual growth, and at the time of writing, 10th October, the animals are still in these paddocks, and although they have not received any supplementary food, their loss of weight has so far been very small. A ration of bone meal and salt was given from the 1st September, 1932.

Grasses Established from Seed.—The grasses established from seed, namely, Buffel and Gonya grass, made much

slower progress in the beginning of the season than those laid down from root divisions. This is largely attributable to the slow initial growth of the seedlings of our perennial grasses and to the intermittent droughty conditions which prevailed for some 6 to 7 weeks after sowing. Germination was somewhat irregular, successive batches of seedlings appearing from time to time. The plantlets, however, proved hardy and capable of resisting hot and dry weather lasting for periods of two or three weeks, and when favourable weather arrived they grew rapidly and eventually produced a luxuriant growth which might have been taken for hay, and later a large quantity of seed. Owing to the uneven ripening of the crop it was not possible to harvest all the seed, but from the Purple-top buffel a yield of 400 lbs. per acre was obtained, and 200 lbs. per acre of Gonya grass seed. A considerable amount of seed was allowed to shed itself with a view to thickening the stand the following season.

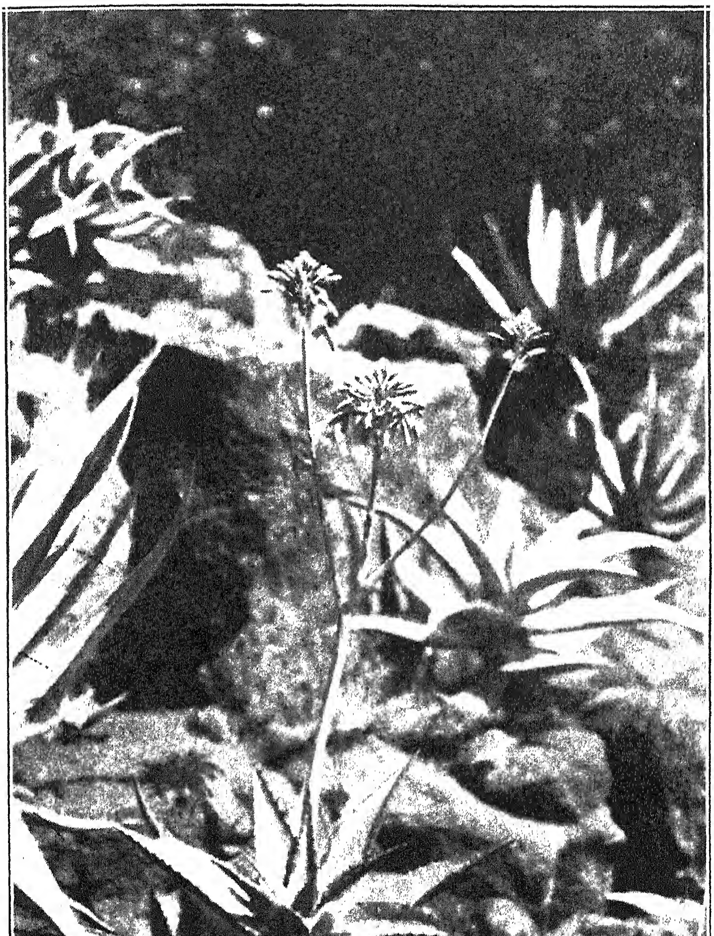
During June and July, by which date frost and drought combined had browned off the greater part of the herbage, cattle were allowed to graze these two paddocks and the leafy portions and much of the remaining parts of the seed culms were readily eaten. The number of grazing days per acre for one head of cattle provided by these grasses was as follows: For the Purple-top Buffel 237 days, and for the Gonya grass 201 days, but since the cattle received a small amount of supplementary roughage the results are not strictly comparable with those recorded for the other paddocks. Owing to a scarcity of seed and, therefore, a thinner sowing per acre, Gonya grass was not established as thickly as was Buffel grass, and this may account for the fewer number of grazing days it provided.

It is desired to emphasise that before these experiments can be considered complete, they must be continued for several more years, and that the results as far as they go are applicable only to the conditions under which the tests have been conducted, viz., on red diorite soil, fertilised to restore in some measure its depleted fertility, and with a rainfall of 25-30 inches spread over the summer months. The very abnormal rains of August, 1932, were unfortunate from the point of view of the experiment, causing as they

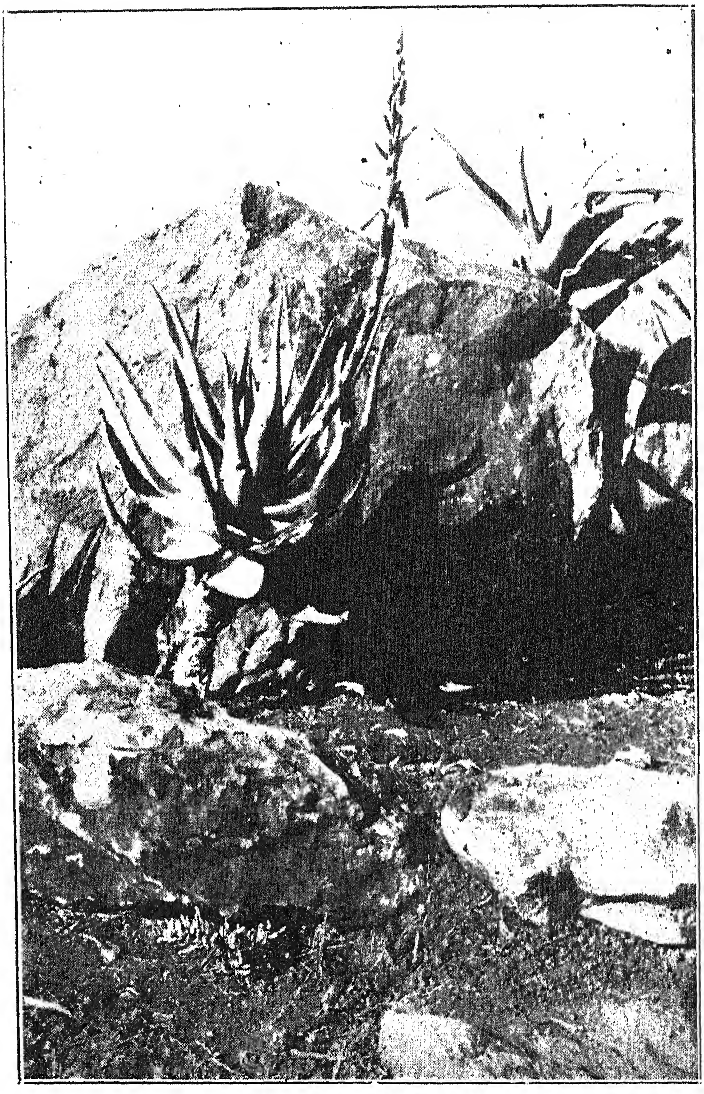
did a quite exceptional spring growth, which has provided more grazing during the past September and October than could usually be looked for.

The investigation, so far as it has proceeded, throws considerable light on the possibilities of establishing improved pastures which, when well managed under a rotational system of grazing, will afford a considerably higher carrying capacity than the unimproved veld. More extensive experiments under different conditions of soil and climate are, however, desirable and it is hoped that farmers who have already established nursery plots of the more promising grasses supplied by the Salisbury Experiment Station will extend their acreages and give the resulting paddocks careful attention. Those who have not yet established nurseries are invited to take advantage of the supplies of Woolly Finger grass roots offered for sale from the Station during January and February at a cost of 10s. per sack of roots delivered free at nearest railway station or siding. Planting material of other desirable grasses, including Creeping false paspalum and Swamp couch (*Haemarthria fasiculata*)—one of the best grasses for vlei soils—can be supplied in small quantities, free of charge, to permit of the establishment of nursery plots.

H. G. M.



A. macrantha.



A. lineata.

A. microstigma.

NOTES ON AFRICAN ALOES.

By H. Basil Christian, Ewanrigg, Arcturus.

PART IV.

Aloe macrantha.—*Aloe macrantha* is one of the numerous spotted leaf aloes which are so much alike in general appearance that it is impossible for even a trained botanist to identify some of them with certainty when not in flower.

It occurs in Natal.

It is an acaulescent plant which increases by means of underground runners, which throw up new plants at a distance from the parent.

The leaves are broad at the base in proportion to their length; they are green, or in the dry season of a brownish tinge, with oblong whitish blotches on the upper surface; the under surface is of a paler green with indistinct longitudinal lines; the margins are armed with rather large, sharp prickles, but there are none on either upper or lower surface.

The peduncle is smooth and branched, reaching a height of 30 inches, and terminates in somewhat capitate heads of yellow flowers.

It flowers freely under Southern Rhodesian conditions in April and May, and again in July.

Aloe microstigma.—*Aloe microstigma* occurs in the Grahamstown and Addo districts of the Eastern Province of the Cape, also at Hex River. It is rather a small acaulescent or sub-acaulescent plant with a dense rosette of leaves, which are erect and incurved; they are light green tinted with liver red colour and are copiously studded with whitish oblong spots on both surfaces; the margins only are armed with small brown thorns.

The inflorescence grows to a height of 2 feet to 2 feet 6 inches, and terminates in a conical raceme. The buds and flowers are at first pale pink and later become bright pale yellow and pendulous.

It flowers freely under Southern Rhodesian conditions from June into August, often throwing up a fresh flower spike as the first dies off. It has not the suckering habit.

This aloe can be obtained from the Winton Nurseries, Bonnievale, Cape Province.

Aloe lineata.—*Aloe lineata* occurs in the Eastern Province of the Cape in the neighbourhood of Grahamstown.

It has a short stout stem from 2 feet to 4 feet high, rarely up to 7 feet. The upper part of the stem is usually covered with the remains of the old leaves.

The leaves are in a dense rosette rather short and upright; they are bright green or slightly glaucous and distinctly lined on both surfaces—hence its specific name—and armed along the margins only with brown prickles.

The inflorescence is stout and unbranched and terminates in an elongated conical raceme of bright red flowers, which become pendulous when fully mature.

It appears to be a shy flower under Southern Rhodesian conditions. It suckers freely from the stem, not the base and it is, therefore, easy to increase one's stock rapidly.

POULTRY INDUSTRY.

THE REARING AND FATTENING OF TABLE POULTRY.

By H. G. Wheeldon, Chief Poultry Officer.

The demand for good table poultry is a consistent and growing one. Owing, however, to the fact that the majority of producers in Rhodesia concentrate on egg production, the supply of desirable table poultry often falls short of the demand. Householders in the past have been perforce content with native hawkers' stock without realising the possible existence of disease in a latent form or the poor value of such purchases. It is not surprising, therefore, that many people now demand well-fed table fowls of better value from reliable sources. This is gratifying, as the development of the industry depends so much upon the discretion exercised by the consumer, and the changed attitude is already having a stimulating effect on the table poultry business in Rhodesia. There are at present in this Colony producers who are concentrating on the production and sale of better quality birds, and these producers deserve all the encouragement possible. On the other hand, it rests with the producers to assure the consumer regular and continuous supplies. Careful attention to the proper preparation of table poultry will be amply repaid, for the discriminating consumer considers both appearance and quality. The ultimate success of the enterprise will depend to a great extent on the condition in which the products are marketed. The appearance of the birds, whether alive or trussed, has an important bearing on the demand and the price received.

The production of ducks and turkeys for table purposes should not be lost sight of, as these serve to maintain regular supplies of desired quality.

It should be pointed out for the benefit of those raising ducks and turkeys that it is most essential, apart from anything else, to breed from standard size stock, for unless this is done it is very doubtful whether the progeny can be raised economically and profitably for disposal to the best advantage.

Throughout the country there are dozens of egg farmers, and although it is a fact that heavy or dual-purpose breeds often form the source of supplies, light breeds are frequently kept for egg production. Every breeding season finds the producer with hosts of young cockerels, which provide a marketing problem and in consequence it has been customary in the past to destroy the male chickens as the sex is distinguished at an early age. It is suggested, however, as an alternative, that surplus cockerels can be to some extent economically converted into a profitable source of income.

Marketing.—In the more developed countries, fattening is a special industry, and a flourishing trade exists in fattened birds. It is a well-known fact that few fatteners actually raise the stock themselves, there being a sufficient margin of profit between producing and marketing to cover the fattening costs. Much can be done, however, in the production of fattened poultry without cramming or other special methods of fattening.

To establish a steady retail trade requires time and tact, and the best advertisement is a satisfied customer. The wholesale business, on the other hand, is easier to get and easy to serve, but it may be taken as a general rule, that the nearer the reach to the consumer the greater is the tact and business knowledge required and the profits are greater. The largest profits are derived from better marketing and from special market advantages in selling the stock.

The commercial egg farmer usually caters for the live poultry market and with the exception of a small trade in trussed poultry, a large number of the poultry sold for consumption in Rhodesia is marketed alive. This practice requires less time and equipment, an important consideration when commercial egg production is the main object. The sale of live poultry is based largely upon weight and to a less extent upon the quality, provided the birds are young, and the care in preparing live birds is thus reduced to a

minimum. The disposal of live poultry is more satisfactory over long distances. The demand for trussed poultry is based mainly on quality and appearance. The latter fetches a higher price per pound, but the killing, plucking and trussing requires experience and considerable time. As the shrinkage in weight of live poultry en route to distant marketing centres is approximately 10 per cent., and as a similar loss in weight is experienced in the trussing process, the choice of trade depends to a large extent upon the proximity to markets. The poultry farmer must decide for himself which is likely to be the more suitable under his own particular circumstances.

In considering the methods to be adopted for the production and disposal of table fowl in this country, it is necessary to mention that the supply of good poultry is seasonal and is not uniform throughout the year. Chickens are hatched and reared normally from April to September, and the surplus young stock available for sale would not reach high proportions until about October and would not continue much beyond January. The seasonal and irregular character of supplies will become of greater importance as the demand increased unless the breeding season is spread over a longer period or other means are adopted to ensure more uniform distribution. Cold storage plays an important part in holding the surplus off the market and thus balances the supply and demand, but storage is unfortunately at present out of the question, as it increases the cost to such a great extent. Under such circumstances it becomes necessary for the producer to endeavour to distribute his supplies by other means, which involve different methods of handling the surplus poultry. For instance, the disposal of cockerels alive by egg farmers is feasible at the age of six to eight weeks, when the sex is distinguishable, and although a supply of eggs for market is the main object, an attempt might be made to encourage a demand for surplus cockerels at this early age. These birds will weigh 1½ lb. at eight weeks old and can be retailed by producers as fryers or disposed of in wholesale lots usually to grain farmers or plotholders in the vicinity of the markets who can either retail or rear these chickens economically to meet the required demand. The hens that have completed their second season

should be reduced in number as soon as possible after the breeding or laying season and disposed of rather than retained through the plentiful period of egg production. The early disposal of these birds should meet a favourable demand at a time when roaster-cockerels are scarce. Lastly, it is suggested to those who can keep their birds economically for 10 months it might be expedient to caponise a number of cockerels each year and such de-sexed birds held over during the flush season if necessary to facilitate the spreading of supplies over a longer period of the year.

The production of table poultry is in a large measure dependent on market requirements and the stock for disposal may be classified to the best advantage as follows:—

Broilers.—In the event of not being able to dispose of all the cockerel supplies at an early age, they should be placed in colony houses and raised for sale as broilers at the age of 12 to 14 weeks. If the birds are well fed, this practice possesses possibilities on many farms for a retail or wholesale trade. At the Salisbury Experiment Station it was found that young cockerels of this grade can be raised profitably. They are usually plump and well grown when fed ordinarily on chick rearing rations and they should weigh from $2\frac{1}{4}$ to $3\frac{1}{4}$ lbs. each or 27 to 39 lbs. per dozen. Such stock can be sold alive or if trussed in pairs or separately neatly packed in cartons. The larger grades of table chickens can also be produced in plump condition though unfattened to meet the local demand if well-fed, without special or crate fattening methods. Young growing stock should be marketed in three different stages, namely, plump or unfattened chickens, trough fed or half fattened chickens, and fully fattened or crate fed chickens.

Capons.—The supply of cockerels by producers can be spread over a greater part of the year if converted into desirable though larger table birds by caponising. In order to lengthen the period of marketing, the production of capons is well worth consideration. The capon does not deteriorate in quality with age, and it may be kept for a reasonable period and sold to best advantage at a time when suitable birds are scarce. They make a palatable roast, and if plump should meet with a ready out-of-season demand in this

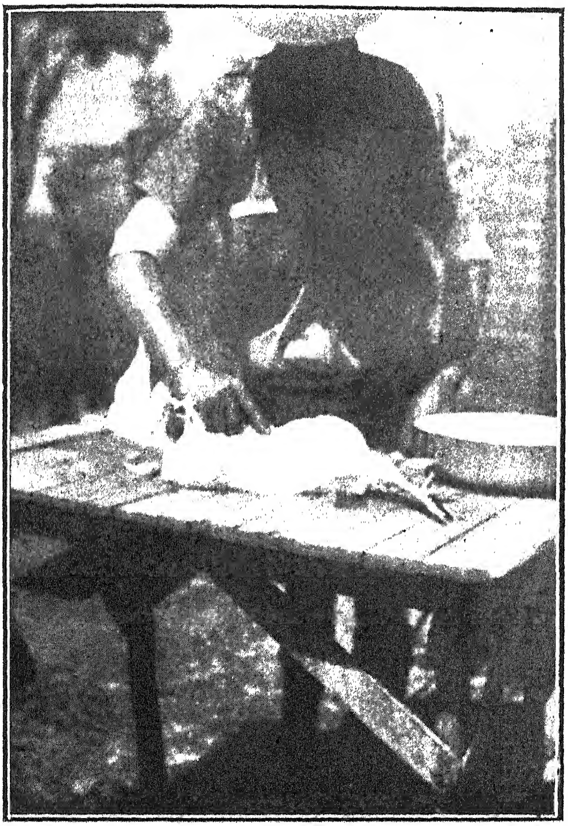


Fig. 1. Caponising. The site of the operation is indicated.

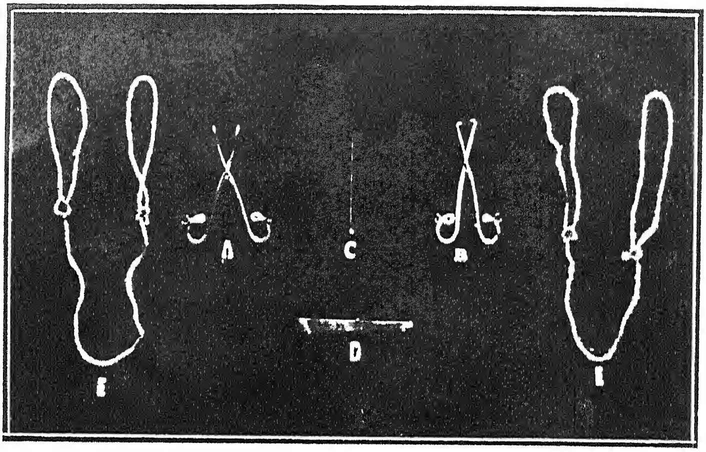


Fig. 2. Caponising. Instruments required.

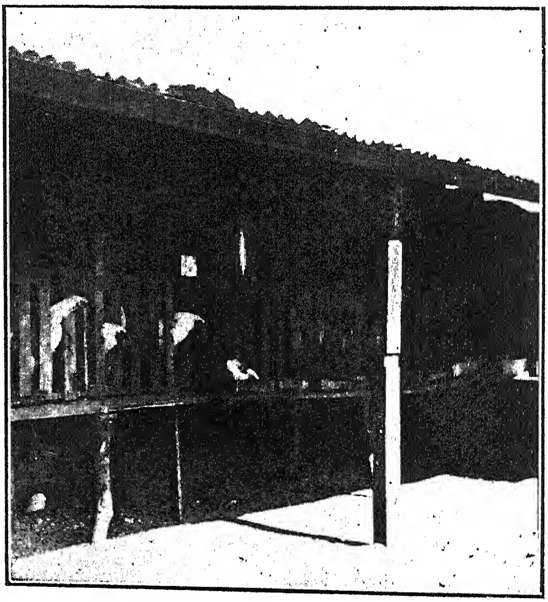


Fig. 3. Fattening crates.

country. The capon becomes docile and loses all inclination for fighting and they can be suitably housed in flocks of 25 birds. By colonising these birds in suitable localities where they can have access to shade and food by foraging this would reduce costs and the expense of fencing. Capons are usually plump and they are light feeders and under suitable environmental conditions, favourable uninterrupted thrifty growth can be expected.

Mature Fowls.—It is necessary to reduce the flock of mature stock by the usual seasonal process of culling. There are also some farmers who desire to limit their egg yield during the flush season of production, and who wish to reduce accordingly their laying flocks of mature stock. Culled hens, if well fleshed as they are usually, make excellent eating when braised. If some of the culled stock is lean but healthy it would be advantageous to producers to retain and fatten any such stock before disposal. This can be done satisfactorily by placing them in crates or small pens and trough fed for a period of one to two weeks. The feeding should consist of moist mash preferably mixed with sour milk or an extra supply of grain will frequently suffice for birds in colony houses. These methods of feeding can be applied generally to all classes of lean poultry which require the finishing touches for ordinary table purposes. The stock offered for sale should at all times be selected according to their condition.

Ducks and Geese.—Ducks are amongst the quickest maturing of all table birds. They are easy to rear and for young fat ducks about 10 to 12 weeks old there is a ready demand. At this age the flesh is palatable and tender and realises a comparatively good price. Up to this period the gain in weight is more economically produced and all ducks intended for table purposes should be sold at that age. The demand for geese is very limited in our warm climate, but they are kept by some farmers for the sale of "down."

Turkeys.—There is usually a good demand for turkeys at Christmas. In the writer's opinion, however, it should be possible to build up a demand throughout the year for young fat toms and poults weighing 6 to 8 lbs. each. It is usually considered that turkeys are fit for consumption

only when they are mature, but young turkeys weighing 3 to 4 lbs. each are favourably commented upon by customers as being better than mature birds. In view of this there are possibilities of a growing demand for young turkeys throughout the year.

Best Breeds for the Purpose.—The suitability of any breed for table poultry production is in a large measure dependent on market requirements and on the extent to which chickens of any breed can be produced to meet the size and quality demanded at the most economical cost.

Information is often sought in regard to cross-breds. The merits of pure-bred stock are well worth considering, because the pullets can be sold for egg production or for breeding purposes. In any case, in comparing the heavy or general purpose breeds and cross-breds with the light or egg-producing breeds, there can be no doubt that the former have the advantage if the production of table chickens is the main objective. The cost of feeding is practically the same. The general purpose and cross-breds are better than the egg breeds in an unfattened condition at a time when taken from the Colony houses in the early season, but this is not always maintained as the chickens grow older. They do better also when trough fed, as they are more docile and less active, but this difference is not always well marked in crate feeding or cramming. In marketing, the superiority of the larger breeds may again become more apparent but the demand for smaller birds, which is a growing one, must not be lost sight of.

The best results can be secured only from the use of strong, healthy, vigorous stock, such as Sussex, Rhode Island Reds and Wyandottes. Any of these and the Orpington crossed with the game varieties make plump chickens, which are well breasted at any age and will fatten readily.

Fattening.—The object of fattening poultry for market is twofold; first, to obtain a gain in weight, and, second, to improve the quality of the flesh. Although the stock will usually retain their plump condition up to the age of 16 weeks, the flesh tends to become firm and hard after that age. The fattening of cockerels may commence at the

age of 16 to 18 weeks and should consist of liberal feeding with limited exercise. It may be said that poultry are fattened to a less extent than probably any other class of live stock. The marketing of poultry, especially trussed poultry, requires considerable improvement before the conditions are ideal. As already inferred, the stock offered for sale should be selected with a view to marketing those that are in good condition. The finishing touches to marketable products yield the best return on the average farm.

Range Fattening.—When the poultry farmer undertakes to fatten his poultry, the most common method employed is range fattening. This method consists of feeding more liberally or supplying a greater proportion of grain, which is likely to produce flesh before the birds are marketed. No other change is made in the care of the birds, and they can be colonised or allowed free range. Such a method of feeding is economical and will result in a gain in weight, especially if the birds were previously in lean condition.

It cannot be expected, however, that if cockerels are permitted to run about they will ever increase in weight to the same extent as when they are kept in confinement. In many parts of the country "half fattened" birds would be more profitable to produce at first by reason of the fact that consumers in most cases are not prepared to pay the price for fully fed birds.

With certain classes of poultry, such as the turkey and guinea fowl, this is the most practical method of fattening, for these birds are semi-wild by nature, and if confined to pens for fattening they are likely to go off their feed after a few days, resulting in loss of weight rather than gain. When turkeys have free range they will fatten on their own accord at certain seasons of the year and will not need a great amount of supplementary feeding.

Pen Fattening.—Where an effort is made to supply better class poultry direct to the consumer, the fattening may be carried out in pens. In fattening fowls or ducklings in large numbers, they may be confined in pens with a small run, and fed heavily a fattening ration (moist mash) for a period of two to three weeks. This method of fattening is suitable and should be adopted for trough feeding chickens,

ducklings and geese. Water fowl fatten very readily in pens; they should not be provided with water for swimming. The flock should not exceed 20 to 30 birds and allow 2 square feet of floor space for each bird. The food troughs should be constructed to prevent the birds from standing on the food.

Crate Fattening.—In crate fattening the birds are confined in crates. This system is adopted to produce the best quality table birds. Vigorous, healthy cockerels should be selected foı this purpose and should be in moderately good condition as they would be, ordinarily, on chick rearing rations or after range and pen fattening. On placing the birds in fattening crates, they should be thoroughly treated with insect powder and the treatment should be ıepeated once or twice during the feeding period. Fowls infested with lice do not fatten well when confined. The birds should be fed sparingly at the commencement, and the first feed should contain Epsom Salts. The salts should be dissolved in water at the rate of 2 oz. to 1 gallon of water, and this solution used to mix a moist mash. This should constitute the first feed during the first 24 hours after the birds have been placed in the crates. Thereafter the birds should be fed two or three times a day but kept moderately hungry during the first week. As the birds become more settled in the crates, the quantity of food may be increased to a full feed three times a day. The quantity of food must be gauged in such a way that the food will be readily consumed within a reasonable time to satisfy the birds. They should have sufficient to satisfy them and yet not quite as much as they could consume; this stimulates their appetite. The food should not be left in the trough from one feed to the next. This is particularly important even when the birds are fed twice a day, except in this case they might be allowed a longer time to consume each meal. If it is more convenient to feed twice a day, the birds should be fed morning and evening.

The length of time required to fatten, depends on the individual birds, as some birds will stand feeding for longer periods than do others. It takes about two to three weeks as a rule to change the quality of the flesh, but some birds cannot stand this feeding for more than 10 days. The birds

should in any case be disposed of when they are noticeably off their food. Although it is possible to feed some birds under this system for 4 to 5 weeks the best gains are made during the first two or three weeks as a rule.

The Crate.—The design of crate commonly used in crate fattening is 6 feet long 2 feet wide and 18 inches high, with partitions 2 feet apart. The crate is thus divided into three compartments 2 feet square. In some cases it is made with two compartments each 3 feet long. The crate can be covered on all sides except the front with 1 inch mesh wire netting, or with slats. The front should be closed with slats placed vertically, 2 inches apart. A dropping board may be provided underneath the compartments and a galvanised iron trough is provided along the front of the crate for feeding purposes. The troughs and dropping boards should be detachable. The crate should be portable but elevated and supported 2 feet from the ground. Each compartment holds 4 adult birds or 6 birds at 14 weeks old. If the compartments used are 3 feet long increase proportionately the number of birds to be confined. The crates should be situated in a cool shady place in hot weather and in a comfortable sheltered position in cold weather.

Feeding.—On removing the chickens from the incubator to the brooders they should be fed on the usual chick rearing rations. They may be allowed constant access to the mash and the hoppers should be constructed to avoid wastage.

The following ration is recommended for rearing heavy and light breeds of poultry:—

Mealie Meal	45 lbs.
Bran	10 lbs.
Pollard	17 lbs.
Oats (rolled or meal)	10 lbs.
Monkeynut Cake	10 lbs.
Meat or Blood Meal	8 lbs. (to 12 weeks)
Bone Meal	2 lbs.
Limestone or Powdered Oyster Shell	1 lb.
Charcoal	1 lb.
Fine Salt	½ lb.

For the first 12 weeks it is desirable to add about 8 per cent. blood meal or meat meal unless thick separated milk is available, when this may be reduced to 5 per cent.

An ample supply of finely chopped green food should always be available, as is also the case with grit, oyster shell and charcoal.

For a grain mixture, munga may be fed alone from the time of hatching until the chicks are eight weeks old, thereafter six parts of crushed mealies should be added to every four parts of munga.

When it is desired to extend the breeding season for the production of table birds and for the rearing of out-of-season hatched chickens, especially those hatched during October and subsequent months, a stimulating ration is required to increase the growth-rate of such stock. This would be effected by increasing the amount of animal food from 8 per cent. to 12 per cent. in the mash ration.

Fattening Ration.—The following rations for fattening both young and old stock are recommended:—

With milk.		Without milk.	
Maize Meal	55 lbs.	Maize Meal	55 lbs.
Pollard	20 lbs.	Pollard	20 lbs.
Mixed with butter milk or sour skimmed milk.		Meat or Blood Meal	10 lbs.
		Mixed with lukewarm water.	

These rations, with a little salt, should be mixed to the consistency of porridge and fed in suitable troughs, sufficient in quantity for the birds to consume readily at each meal. Fresh clean water should be accessible at all times and green food supplied daily. It is necessary to supply grit three times weekly when part of the ration is composed of grain. Grain should not be supplied to crate fed birds. Unless the food is palatable, the birds will not consume sufficient for the best gain in weight. Salt increases the palatability and the foods must be of good quality. If milk or butter milk cannot be supplied in sufficient quantities, animal food of some kind must be supplied. To advance the process of digestion the mash should be half sour, this is obtained by mixing the food with sour milk

or butter milk or mixing the food in advance of each meal to allow it to become slightly acid.

Crate for Dispatching Birds.—The coops for sending live poultry to market should be 3 feet long, 2 feet wide and 13 inches high. A coop of these dimensions will accommodate 10 to 12 adult fowls or ducks and 15 to 18 chickens, depending upon their size. For 6 turkeys a coop 20 inches high is required. The coop should be as light as possible consistent with durability to save freightage. The frames can be made of sound wood (1 x $2\frac{1}{2}$ inches), whilst the tops and sides should be covered with 1-inch wire netting to provide plenty of ventilation. The bottom of the coop should be solid, consisting of planks $\frac{1}{2}$ inch thick nailed closely together to prevent injury to the feet of the birds.

Caponising.—By caponising is meant the removal of the generative organs of the male chicken, thereby destroying his power to breed. The de-sexed cockerel is thus termed a "capon." He becomes very docile, slow of movement and loses all inclination for fighting, and is content to keep his own company. His spurs keep growing, but the comb and wattles diminish rather than increase in size. They also lose their bright red colour. The flesh of a capon remains tender; he fattens readily and produces a plump, juicy, fine-grained flesh. If given sufficient time, he grows to a much larger size than would be the case if not caponised. Capons readily adapt themselves to close confinement and seem to devote their energy almost entirely to eating and growing. The desirable qualities of quick growth and ready fattening which the capon possesses are particularly favourable to the production of plump, profitable table birds.

A set of modern instruments for performing the operation should be obtained. A dish containing antiseptic solution, which should be used cold, and two cords 3 feet in length, a sponge or a piece of absorbent material such as cotton wool, with a needle and cotton completes the requirements. Whatever the season of the year, the cockerels to be operated upon should be young, usually from 8 to 12 weeks old or weighing from $1\frac{1}{2}$ to 2 lbs. The age for caponising will, therefore, depend upon the breed, as some mature earlier than do others.

A good indication that they are in fit condition also is immediately they commence to crow. There are certain precautions necessary before the operation is commenced, small details they may seem, but if neglected will cause the most serious results. The birds to be caponised should be kept in a clean coop and should be starved for 24 to 36 hours. Water may be withheld two hours before the operation in order thoroughly to empty the system of all food, as it is almost impossible to caponise with ease and successfully if the intestines contain food. The instruments should be perfectly clean and when not in use should be placed in the dish containing disinfectant during the operation. It is necessary to emphasise that cleanliness is important and the operation should be done quickly but carefully.

The best plan to follow is to experiment with one or two dead fowls. In this way there will be less danger of causing unnecessary delay when the operation is attempted for the first time with live birds. A little confidence and a bright sunny day are required to perform the operation satisfactorily.

The mode of procedure is as follows:—

Take a piece of stout cord about 3 feet in length with a running noose at each end. One noose is fastened above the hocks of the bird and in the other loop a stone or suitable weight is fastened heavy enough to hold the bird. The other cord is tied around the wings close to the body of the bird, and to the other end of this a weight is attached. The bird is then laid upon its side on a table or box of convenient height for the operator, and the two weights allowed to hand over the opposite sides of the table, thus holding the bird stretched out in proper position.

A few feathers should be removed from the uppermost side of the body in front of the thigh, and the feathers around this area damped in order to keep them lying close to the body. The bare patch should be bathed with the antiseptic and water solution, which has the effect of cleaning and numbing the skin. The skin should be elevated by gripping it with thumb and fore-finger and an incision about 1¼ inches is made in the skin just above the first two ribs next to the thigh. Then carefully locate the space

between these ribs, at this stage care should be exercised in regard to the thigh muscle, which in the case of some birds covers the first two ribs. This muscle should be held on one side before any further incisions are made, for if it is lanced it will not only cripple the bird, but will cause excessive bleeding and thus delay the operation. The tissue between the ribs should be penetrated with the lancet about $\frac{3}{4}$ inch from the backbone, this incision should be large enough to place the spreaders in position, thus keeping the ribs apart, while it is extended 1 to $1\frac{1}{2}$ inches in length.

It is important in extending the incision to cut towards the breast bone, not towards the spine, in order to minimise any risk of cutting the kidneys, which would be fatal. Within the body cavity a thin transparent membrane will be observed, this is the lining of the abdominal cavity and should be carefully pricked open, when the interior of the abdomen will become visible. The organ to be removed is light in colour and the shape of a bean and is attached close to the backbone. The usual course is to insert the extractor, pass it around the organ, and take a firm hold of the ligament and artery by which the organ is attached. When this is done the organ is detached by carefully twisting the extractor and at the same time gradually withdrawing the instrument containing the organ. If the detached organ falls into the abdomen it should be recovered with the extractor, otherwise serious complications will arise. It is then necessary to stitch the skin with needle and cotton, carefully drawing the cut surfaces together and tying them firmly. Although it is customary to remove the organs separately by turning the bird over and repeating this operation on the other side, it is possible to remove both the organs through the one incision. This, however, requires considerable experience, as it is accompanied by greater risk of fatal injury and is not as easy or expeditious as operating on both sides. When both organs are to be operated upon through the same incision, the lower one should first be removed.

After completing the operation the birds should be placed in suitable quarters without perches, but well littered with clean hay, and a good plan is to give them water and a feed of soft food immediately. The wound soon heals and the birds may be given their usual rations after two or three

days. It is not unusual for some birds after the operation to develop air puffs or inflation, which is an accumulation of air under the skin. This condition can be relieved by opening the skin with a needle or the point of a knife and pressing out the air.

Capons may be fed on the usual chick rearing rations. A grain ration should be given in addition to mash. Capons should be colonised or kept on free range to make the most economical gains during their long growing period. They should be fattened for two or three weeks before they are marketed, by increasing the maize meal and maize in the ration either whilst on range or when confined in pens.

Light portable grass shelters such as are used for colonising growing pullets make very desirable quarters for growing capons.

GWELO MUNICIPAL DEMONSTRATION STATION.

ANNUAL REPORT FOR YEAR 1931-32.

By D. E. McLoughlin, Assistant Agriculturist.

The season under review was not a favourable one for crop production although the total precipitation amounted to 25.35 inches at the Sand Veld Station and 25.64 inches at the Gaol, situated in the township.

The following table gives the distribution of the rainfall for the season and the average for previous years:—

Month.	Rainfall 1931-32.	Total No. of rain days.	Greatest amount in one day.	Average for 30 years to 1929-30.
July	0.10	1	0.10	0.02
August	—	—	—	0.08
September	—	—	—	0.17
October	0.36	2	0.19	0.74
November	5.15	12	1.35	3.66
December	1.34	5	0.48	6.00
January	4.99	16	1.07	5.98
February	2.39	9	1.20	5.33
March	10.07	13	2.17	3.34
April	1.14	8	0.49	0.71
May	0.10	1	0.10	0.32
June	—	—	—	0.02
Total	25.64	67	2.17	26.37

Gwelo Experiment Station (Sand Veld).

Month.	Rainfall 1931-32.	Total No. of rain days.	Greatest amount in one day.
July	0.02	1	0.02
August	—	—	—
September	—	—	—
October	0.25	2	0.15
November	5.69	9	1.40
December	1.58	5	0.85
January	6.05	13	1.04
February	3.22	12	1.51
March	7.28	15	1.70
April	1.25	8	0.50
May	—	—	—
June	—	—	—
Total	25.35	65	1.70

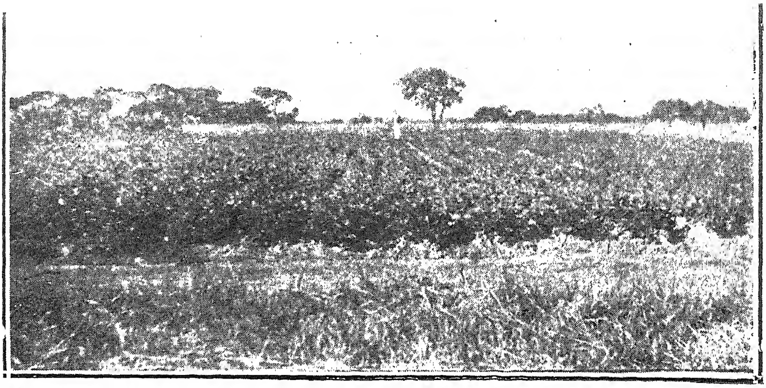
At first glance a total fall of 25.35 inches would appear to be a satisfactory one, but when analysed the distribution is found to be very unfavourable. Mr. Hopkins, who is in charge of the two stations, reports as follows:—"There were several prolonged droughts, each sufficiently long in duration to be distinctly harmful in its effects; these periods were from the 17th November to the 1st December, 4th to 19th December, 23rd December to 13th January, 31st January to 16th February and from the 17th March to the 15th April. During the months November to April, there were in all 20 days without rain in November, 26 days in December, 18 days in January, 17 days in February, 16 days in March and 22 days in April. The absence of rain, combined with high temperatures during the early period of growth and at other critical stages was responsible for the reduced yields recorded. Particularly do these remarks apply to the red soil station where conditions were less favourable, and although there is no rain gauge there, I am able to state definitely from careful observations that many showers recorded at the sand veld station and nearby did not extend to the red soil station.

RED SOIL STATION, GWELO.

Fig. 1. Plot No. 7. In foreground, velvet beans to be reaped (after oats). In background, maize plot No. 6 plus 200 lbs. superphosphate per acre (after velvet beans reaped).

Fig. 2. Plot No. 9. Maize plus 8 tons kraal manure per acre (after maize).

Fig. 3. Plot No. 14. Ground nuts plus 200 lbs. superphosphate per acre (after maize).



SAND VELD AREA.

Fig. 4. Plot No. 7B. Ground nuts (after oats plus kraal manure).
Fig. 5. Plot No. 8A. Maize and velvet beans plus 6 to 7 tons kraal manure per acre.

"The early rains enabled a good seed bed to be prepared and an excellent germination followed. Sowing was commenced on the 8th November and the maize plots were completed by the 13th November, up to which date the precipitation registered at the sand veld station was 4.12 inches.

"The application of Derisol for the control of maize stalk-borer, in the early stage of growth, proved very efficient and practically no reduction in yield can be attributed to this pest. On the red soil station the maize ears were considerably smaller and the grain lighter than on the sand veld section."

Red Soil Area.—The total yield of maize from 5¾ acres was 9,304 lbs. of grain, or approximately 8 bags per acre, as against a yield of 10 bags an acre from 6 acres on the sand veld station.

Yields here of ground nuts, too, compared with previous seasons are such as almost to be regarded as failures, the best yield being only 5.6 bags as against the excellent return of 26.55 bags per acre on the sand veld section. The quality on both stations did not reach the standard of previous years, the kernels not being as plump. The following crops failed on account of drought: Summer wheat, Hull-less, Kherson and S.E.S. oats.

Rotation Experiments.—Two four course rotations are in progress, the land in each during the four years growing two crops of maize, one of ground nuts and one of sunn hemp (Series "A") and two crops of maize, one of dolichos beans and one of oats (Series "B").

In Series "A" no animal manure is used, but a green manure crop is ploughed under every fourth year, and the following maize crop receives artificial fertiliser. In 1923-24 and 1924-25 the maize after green manure received 150 lbs. complete maize fertiliser per acre and from 1925-26 to 1930-31, 200 lbs. of bone and superphosphate, since when the dressing has been amended to 250 lbs. raw rock phosphate per acre.

Commencing 1931-32 the second maize crop in this series receives 200 lbs. bone and superphosphate per acre and no fertiliser is applied to the ground nut crop, which in past years received direct 200 lbs. superphosphate per acre.

In Series "B" 7 to 8 tons of kraal manure per acre are applied to the maize every fourth year, while the legume crop—dolichos beans—is reaped for grain or fodder and the residue only is ploughed in. Thus in these two systems the necessary supplies of organic matter are provided by kraal manure and green manuring respectively, and the relative values of the two are compaied.

The maize continuous plot provides a check on the above rotations. On the one half of the plot maize has been grown year after year without any treatment and on the other half of the plot the maize receives 150 lbs. bone and superphosphate every alternate year, but no organic matter has been applied either by means of green manuring or farm manure.

RED SOIL STATION: ROTATION EXPERIMENTS, SERIES "A."

Plots of ½ acre each.

Yields of maize in bags of 200 lbs. each per acre.

Yield of ground nuts in bags of 75 lbs. each per acre.

Crop.	1928-29 to 1931-32 Av. yield for 2nd period. Av. annual rainfall 26.4 inches.	1924-25 to 1927-28 Av. yield for 1st period. Av. annual rainfall 26.41 inches.	Av. yield per acre for 8 years.
Velvet beans / *Sunn hemp } Ploughed under	—	—	—
*Maize: received 200 lbs. per acre bone and superphosphate after green manure ploughed under, up to season 1930-31	12.70	14.44	13.57
*Maize: without fertiliser, after maize receiving fertiliser up to season 1930-31	11.11	11.25	11.17
*Ground nuts: received 200 lbs. per acre superphosphate after maize receiving no fertiliser, up to season 1930-31	14.60	18.40 (3 years)	16.50

* *Commencing* 1930-31, *Sunn hemp replaced velvet beans as a green manure crop. From* 1931-32, *the maize following Sunn hemp ploughed under received* 250 *lbs. raw rock phosphate per acre, and the maize previously unfertilised* 200 *lbs. bone and superphosphate per acre. From same date ground nuts receive no fertiliser.*

SERIES "B."

Yield of velvet beans and dolichos beans in bags of 200 lbs. per acre.

Crop.	1928-29 to 1931-32 Av. yield for 2nd period. Av. annual rainfall 26.4 inches.	1924-25 to 1927-28 Av. yield for 1st period. Av. annual rainfall 26.41 inches.	Av. yield per acre for 8 years.
Velvet beans, reaped	—	3.14	—
†Dolichos beans, reaped	5.17	—	—
Maize: receives 200 lbs. superphosphates per acre; after beans reaped	12.29	9.60	10.95
Maize: receives 7-8 tons farm manure per acre; after maize plus fertiliser	13.45	15.10	14.26
Oats (Kherson): after maize plus farm manure	900 lbs. (1 year)	604 lbs. (1 year)	752 lbs. (2 years)
MAIZE CONTINUOUS.			
‡"A" Maize continuous without treatment	7.01	5.85	6.43
"B" Maize continuous: receives 150 lbs. per acre bone and superphosphate every third year (fertilised 1930-31)	9.60	9.40	9.5

† *Commencing* 1930-31, *dolichos beans replaced velvet beans.*

‡ *In* 1927-28, *fertiliser was by error applied to Plot "A" instead of Plot "B."*

The average yields given above are for the four years in each period and for the eight successive years in which crops were reaped for grain. In the first year, 1923-4, owing to rawness of land, late ploughing and planting and drought all crops on the station were poor and maize was reaped for silage.

These rotation experiments demonstrate that by a well balanced system of cropping which provides for an adequate supply of humus in the soil, combined with dressings of phosphate fertiliser once or twice in the four-year period, the fertility of the land can be increased and heavier yields secured, particularly in seasons experiencing droughty conditions. Convincing evidence of the beneficial effects of green manuring is provided by the results following a legume

ploughed under combined with two dressings of phosphatic fertiliser, compared with an application of 7 to 8 tons of kraal manure and one dressing of phosphatic fertiliser. In the unfavourable season under review, the maize plus raw rock phosphate following a green manure, exceeded the yield of the maize plus kraal manure by two bags per acre, and in six years out of eight, when the precipitation failed to exceed 23.5 inches, by an average of a quarter of a bag per acre. In two seasons out of the eight, when the precipitation exceeded 23.5 inches, namely, in 1924-25 with 47.21 inches and 1928-29 with 34.07 inches, there was a difference of 3.5 bags an acre in favour of the kraal manure.

Legumes and Green Manure Crops.—The suitability of a legume possessing an upright growth and which will permit of harvesting by machinery is of considerable importance, since the trailing legumes at present grown, namely, velvet beans, dolichos beans and cowpeas or kaffir beans must be harvested by tedious hand methods. The suitability of the soya bean as a rotation crop with maize and as a grain and fodder crop is receiving much attention at the Salisbury Experiment Station, and trials have been in progress for three seasons at the Gwelo station to test the merits of this crop under the conditions of soil and climate pertaining to the Midlands. Experience has shown that except on soils heavily manured or containing much organic matter, the crop is not likely to succeed without inoculation being effected, either by means of approved commercial cultures of soya bean bacteria or possibly by soil previously inoculated. The requisite bacteria for the inoculation of the soya bean plant do not appear to occur naturally in any Rhodesian soils, and points which require further study are the length of time bacteria introduced by inoculation of the crop can remain alive in the soil and the frequency within a rotation with which soya beans must be grown to enable the bacteria to survive from one planting of the crop to the next.

The season under review was not a favourable one for soya beans although the yields of grain are slightly in excess of those obtained the previous year. Growth was not so vigorous, but the reaping of the grain was better understood

and more satisfactorily carried out. The formation of root nodules in the inoculated plots was observed, and disclosed the fact that more nodules were formed towards the latter end of March than in the early part of the growing season (January-February).

Both in 1930-31 and 1931-32 the yields of grain from the inoculated plots exceeded that of the uninoculated plots, and similar results were obtained in the second year, on plots inoculated in 1930-31.

SOYA BEANS.

Yields in lbs. per acre.

	Season 1930-31. Rainfall, 21.88 ins.	Season 1931-32. Rainfall, 25.59 ins.	Average yield per acre (2 years)
Inoculated	700	700	700
Not inoculated	488	596	542
After soya beans inoculated 1930-31	—	780	—
After soya beans not inoculated 1930-31	—	560	—

Dolichos and Velvet Beans.—Better average yields of grain have been obtained with the small brown seeded dolichos than with any variety of velvet bean or cowpea on account of its ability to thrive under extreme climatic conditions. In the rotation experiment, the qualities of the dolichos bean are again admirably demonstrated, with a return of 1,200 lbs. of grain per acre. In addition to providing heavy yields of grain, this bean is advocated as a valuable soil improving crop, being generally suitable for either grain, hay, silage, or green manuring. Its hay is less fibrous and more palatable and its yields greater than that of the velvet bean. The dolichos bean is of the utmost value to the "mixed" farmer though on purely maize and grain farms it has been almost wholly superseded by Sunn hemp, on account of the latter's merits as a combined weed-smother and green manure crop.

The opportunity may be taken here of referring to the question of witch weed and its prevalence in parts of the

Midlands. That the parasite should appear particularly prevalent on farms where green manuring has been combined with the regular use of artificial fertilisers is not as illogical as it might at first glance appear. The farmer's lack of attention to witch weed and its control has permitted the invasion of the weed and allowed of its spread until the land has become densely infested with seed. High soil fertility then further encourages the growth of witch weed owing to the more vigorous growth of the root system of the maize. It has been suggested that a wise policy would be to refrain from fertilising and green manuring, but this is far from being wise, since in the absence of both treatments the maize would fail entirely from combined lack of fertility and attack of the weed.

In the case of heavy infestations of witch weed the maize grower can at one and the same time increase the fertility of the soil and eradicate the weed. This may be done by substituting trap-cropping for green manuring, using for the former purpose either Sudan grass or certain varieties of kaffir corn. Results obtained at the Salisbury Experiment Station indicate that the ploughing under of two crops of kaffir corn in one season, each of about eight weeks' growth, is about as efficacious in adding organic matter to the soil as one legume crop ploughed under.

Sand Veld Station.—The season under review was a favourable one for this station. The land here, though admittedly very low in fertility, suffers more on account of bad drainage than from actual poverty, and crop yields are reduced more heavily by an unusually wet season than are those on the red soil area. On many of the plots there are depressions of considerable size, while on others the soil is shallow and stony. The land as a whole is considerably inferior to the average soils brought under cultivation on most granite farms, and in consequence considerably higher average yields should be obtained elsewhere with the same cultural treatment than those recorded here. The inadequate depth of surface soil adversely affects crops in seasons of either low or excessive rainfall.

The normal treatment accorded to ordinary soils failed here to maintain the land in good fertility and in consequence

applications of kraal manure at the rate of six tons per acre were applied as follows to plots in rotation A. In the season 1926-27 to all the plots, in 1927-28 to half the acreage, in 1928-29 to a quarter of the land, and in 1929-30 to all of the plots.

In rotation B only one quarter of the acreage received six tons of kraal manure per acre in the seasons 1926-27, 1927-28 and 1929-30, but in 1928-29 all the plots received this treatment.

With a view to further augmenting the organic matter supplies, the maize was annually undersown to various legumes intended to be ploughed under after the main crop was stooked.

Prior to 1929 legumes, including soya beans, dhal, wedge pea, gram, velvet beans, Jack beans and cowpeas, were tested for undersowing. The only one, however, which proved satisfactory was the cowpea or kaffir bean, and most of the plots thus did not benefit to any extent by this undersowing owing to failure of the legumes. In some seasons conspicuous by absence of late rains, the cowpea undersowings also failed. Although in certain favourable seasons satisfactory returns of maize have been obtained from this land, it cannot be claimed that on the average crops have responded to the treatment in the manner anticipated. The reasons for this lack of response have already been explained.

Owing to the poor yields it had recently given, the whole of the sand veld area in 1930-31, excepting plot No. 5, was green manured with Sunn hemp fertilised with 200 lbs. raw rock phosphate per acre, the green manure being ploughed under in March, 1931. The growth was so heavy and the ground so hard, owing to lack of rain in February and March that year, that the greatest difficulty was experienced in turning the crop under.

It is of considerable interest, however, to note the surprisingly good yields produced by this poor soil after the green manuring, and the following remarks by Mr. Hopkins

on the moisture content of the soil when ploughing the land the following winter are also deserving attention:—

"One obvious result of the green manuring with Sunn hemp last season is the increased moisture content of the soil, which factor is most noticeable at the present time (July, 1932) during ploughing operations. The maize cobs, too, were considerably larger, better developed and much more uniform in size than those produced in any previous season. Here also derrisol applied in the early stages of growth had remarkable results against maize stalk-borer."

It will be enlightening to observe the subsequent yields which may be produced after this green manuring and the number of successful crops that can be grown before again having to resort to green manuring.

The total yield of maize from six acres was 11,888 lbs. of grain, or 10 bags per acre, as against 8 bags per acre on the red soil area. The highest yields were obtained in the rotation plots, series A, plus kraal manure—16 bags per acre; and in series B, also with kraal manure—15 bags per acre.

ROTATIONS.

In both the four-course rotations followed, half the land each year is under maize, a quarter under ground nuts and a quarter under oats. In series A the lands receives 200 lbs. per acre of bone and superphosphate and six tons kraal manure per acre every four years, the former being applied to the maize following the ground nut crop which receives the kraal manure. Commencing 1931-32, the manure is applied to the maize crop following ground nuts and the fertiliser to the second maize crop.

In series B the cropping is a duplicate of that in series A. A fertiliser dressing of 200 lbs. per acre of superphosphate is applied to the ground nut crop, and the maize receives the kraal manure. Commencing in 1929-30, the one maize crop in each series is underplanted at the last cultivation in January to cowpeas. From 1932-33 a legume will replace oats in both series, and whenever considered necessary will be ploughed under as a green manure.

ROTATION SERIES "A."

Yield in Bags per Acre.

Crop.	1931-32 25.59 inches.	1929-30 23.39 inches.	1928-29 33.54 inches.	1927-28 19.64 inches.	1926-27 19 inches.	Average yield.
Maize: up to 1929-30 received 200 lbs. bone and superphosphate per acre following ground nuts	15.92	3.6 KM	4.6	6.5	15.0 KM	9.12
Maize: no treatment, following maize receiving fertiliser ...	13.13	4.0 KM	5.1	5.6 KM	11.0 KM	7.77
Oats: following maize ...	Failure	312 lbs. KM	580 lbs.	failed	failed	446 lbs.
Ground nuts: Up to 1929-30 received 6 tons kraal manure per acre following oats	26.55	10.5 KM	7.0 KM	10.8 KM	20.0 KM	14.97

KM = Kraal manure applied at the rate of 6 tons per acre.

In 1926-27 all plots received a dressing of six tons per acre of kraal manure. In 1927-28 the maize after maize plus fertiliser received six tons of kraal manure per acre, and in 1929-30 all plots again received six tons of kraal manure per acre. In 1930-31 all plots were green manured with Sunn hemp, which received 200 lbs. raw rock phosphate per acre.

It will be observed that in three seasons out of five the oat crop has failed entirely, and it is now concluded that the rainfall of the Midlands is too unreliable to warrant the growing of oats as a rainy season crop on upland soils.

ROTATION SERIES "B."

Yield in Bags per Acre.

Crop.	1931-32	1929-30	1928-29	1927-28	1926-27	Average Yield.
Maize: no treatment, following ground nuts plus fertiliser	11.51	6.3	3.8 KM	3.2	10.5	7.06
Maize: receives 6 tons kraal manure per acre, following maize without treatment ...	14.39	4.0 KM	4.8 KM	6.9 KM	13.5 KM	8.72
Oats (Kinvarra): No treatment, following maize receiving kraal manure	failed	—	372 lbs. KM	failed	failed	372 lbs. (1 season)
Ground nuts: receive 200 lbs. per acre of superphosphate	15.2	15.2	7.6 KM	9.3	16.0	12.7

KM = Kraal manure applied at the rate of 6 tons per acre.

In 1930-31 all plots were green manured with Sunn hemp, which received 200 lbs. raw rock phosphate per acre. In 1931-32 no fertiliser was applied to the ground nut crop.

In this rotation the oat crop has failed entirely in three years out of five.

Ground Nuts.—The highest yields of this crop on the sand veld station were 27 bags per acre in 1928-29 and 26.5 bags in 1931-32. On the red soil station the highest yield has been 23 bags per acre. The average yield per acre for Spanish bunch variety over the seven-year period for all plots on the station, including rotation plots which invariably give good returns, is 13.5 bags per acre. Virginia bunch out-yielded Spanish bunch on both stations when planted three weeks earlier than the Spanish bunch. The difference between the average yield of all plots was 6 bags an acre in favour of Virginia bunch.

This variety is slower to mature and should be planted two to three weeks earlier than the Spanish bunch.

From the above returns it will be seen that ground nuts are one of the most dependable and profitable crops to grow on poor sandy soils such as exist on this station. But it should be emphasised that the crop requires a well drained soil and that the best results are obtained when it is grown in a suitable rotation on land well supplied with organic matter.

Apart from tobacco, the ground nut should prove one of the most profitable crops that can be grown on the upland sandy soils. It can be grown economically on this class of land for the following reasons: Good stands can be obtained with a maize planter fitted with a ground nut planting attachment, the additional cost of which with one machine is only 20s.; the friable nature of the soil permits of the better development of the nut and under such conditions larger yields and a higher percentage of large exportable nuts are obtained; the lifting of the crop by "pulling clean" can usually be practised, thus reducing labour in harvesting; the colour of the shells of sand veld nuts appears more acceptable on the overseas market for the "barrow" trade, and the further treatment of scouring or bleaching of the shells, less laborious and costly.

The crop is one pre-eminently suited to sand veld soils and the results on this station during the past seven years provide a plain demonstration of the fact that ground nuts may well become an important product of Midland farms. The average yield of Virginia bunch nuts from acre plots on the sand veld station in 1931-32 was 20.12 bags and of Spanish bunch 14.35 bags, while of the latter variety the average yield of all plots, well and indifferently treated, over the past seven years, has been 13.5 bags an acre.

THE GROWING AND HANDLING OF GROUND NUTS FOR EXPORT OVERSEAS.

Contributed by a Ground Nut Grower of considerable Experience.

The following article by one who has for several years exported unshelled ground nuts to England for the confectionery and street barrow trade, is published in the confident belief that it will prove of the utmost value to many growers of this product. We trust that the information provided will assist in placing the industry on a sounder basis and will help towards securing a permanent outlet overseas for a crop which the Colony might produce in very large quantities.

Visitors to the Department of Agriculture's exhibits at the last Salisbury Show may recall having seen a sample of "washed nuts" grown on heavy red soil and also an exhibit of clean white nuts grown by a farmer on sand veld. Both exhibits bore excellent testimony to the efficacy of scouring nuts in sharp sand and water.—Division of Plant Industry.

The successful export to overseas markets of ground nuts in shell depends from a financial point of view mainly on two factors: (1) the state of the market on arrival of the

consignment, (2) the quality of the nuts and the appearance of the shell. The nuts should usually contain 3 to 4 kernels in each shell.

The market for this commodity in my experience is a fluctuating one. I exported through the Farmers' Co-op., Ltd., Salisbury, for two seasons, namely, in 1930 and 1931. The first year I struck a good demand for nuts in the shell and realised a good price, I think it worked out at 17s. per 112 lbs. nett on rail. In 1931, although my nuts were very carefully selected and in my opinion were good, I did not happen to strike a good market, and the two consignments of 11 tons realised 9s. 9d. nett Salisbury, based on an average overseas price of 23s. per cwt. (£23 per ton). This year I learn prices have been very much higher.

Seed Selection.—I have been selecting my seed very carefully for the last four years, and aim at planting nearly all 4-kernel nuts. I firmly believe that 70 to 80 per cent. of my nuts now contain 3 and 4 kernels. Last season I tested a small plot of 5-kernel nuts. These I planted by hand in rows 2ft. 6in. apart and 12in. between plants in a plot half an acre in extent. I actually reaped 30½ bags of nuts from this half acre, which is equivalent to 61 bags per acre. The nuts were good and extra long and 60 per cent. of them contained four kernels in the shell; a small percentage contained 5 kernels. By planting all the 5-kernel nuts again I hope to increase the percentage of these. Last year I found three nuts containing six kernels.

Planting Distance and Cultivation.—For the production of export nuts in shell I do not agree with the closer spacings usually recommended for commercial nuts. I find that wider spacings give one a much larger percentage of exportable nuts and that with a spacing closer than 2ft. 6in. between the rows the nuts are disturbed and become deformed and simply cannot be compared with those produced from plants with plenty of room to expand between the rows. The advantages of spacing the rows 2ft. 6in. apart and 6in. between plants are (a) one can get the rows fairly straight when using a planter fitted with a ground nut attachment, whereas when splitting the rows it is more difficult to space the drills at a uniform width, (b) the rows are conveniently

wide to permit of cultivation by oxen and implements without damaging the plants and nuts in their various stages of development.

I am most careful to cultivate only when the soil is in a fit condition, and never cultivate the nuts by hand. My crop is cultivated three times with an ordinary 5-tooth cultivator; with the last two cultivations the wings are attached to throw the earth against the plants in ridges.

With the exception of special seed grown under test, I always plant by machine, using a maize planter fitted with special plates, and obtain very good stands in the field. Planting receives every consideration with me, as I aim at a perfect stand. I experience very little trouble in the splitting of the kernels when planting by machine. Much of the trouble with split kernels is due to the seed being too dry at the time of planting. I find that by placing damp sacks over the kernels overnight they absorb moisture, which prevents them from splitting.

When shelling the nuts by machine, the same principle applies.

Soils.—Even at this stage of farming in Rhodesia a great many farmers to-day do not appear to know suitable ground nut soil when they see it. Only recently a fellow farmer who visited me astounded me by saying he had no suitable soil for ground nuts on his farm. I had been on his place on many occasions and once made a report on his farm, and believe me he has the finest soil for ground nut cultivation in Rhodesia.

On my own farm I have two classes of soil, both red. The land in the heavy clearing gives the heavier yield, but the nuts are not so clean. On slightly lighter soil found on the edges of the heavy timbered land the nuts "pull" quite clean, although this soil is also red. On 50 acres of this latter class of soil, ploughed last dry season, with the soil turning up rough and the grass and roots not properly rotted, I obtained 15 bags of nuts per acre without any fertiliser, and when spacing the rows 2ft. 6in. apart.

Reaping and Shelling.—My ground nut operations are mostly based on contract work. My natives "pull" 2,400

yards each per diem, and on this job they are *not on task* as it has to be done carefully and cannot be hurried. Twenty natives gather and place into "cocks" 50 acres in one and a half days. All natives pick two bags of nuts from the vines per diem on contract, and carry the bags to the shed. In selecting and sorting the nuts, each native does two bags a day. On many of these tasks some natives finished up by 1 p.m. and not one later than 4 p.m.; they got to like their tasks and I never attempted to increase their amount of work.

Shelling.—Two natives with my hand-sheller turn out 20 bags per diem. After I have shelled about 100 bags I put the kernels through a winnower and then one native grades one bag per diem. The shelling and grading I find to be a simple matter. The job is performed by a series of sieves which turn out a good sample. If only the shelled kernels could be marketed profitably it would solve many difficulties and reduce the export costs in certain directions; although, however, the treating of the shells is now quite a simple and easy process with the water and sand method of washing.

Date of Planting.—The Spanish Bunch variety in my district I consider should be planted normally during the first week in December, as this enables one to "pull" the plants before the ground dries too hard. With late plantings I estimate that from 5 to 10 per cent. of the nuts are left behind in the ground and generally these represent the best nuts; hoeing these out by hand or with scrapers is a very tedious job, and using the badzer a large percentage are generally damaged.

Cleaning Ground Nuts with Sand and Water.—I read with great interest of the process of bleaching nuts with a solution of sodium bisulphide (described in the April, 1932, issue of the *Rhodesia Agricultural Journal*), and, as this year my nuts were discoloured owing to the late rains in April, I undertook and perfected a very simple and inexpensive method of removing the dry particles of soil adhering to the shells as well as of bleaching them beyond recognition.

The following is the method of washing in sharp sand and water which gave me such remarkable results. I used

a 44-gallon petrol drum fitted with two windlass handles fixed by flanges to the centre on either side of the drum, the windlass and drum being mounted on two poles let 24in. into the ground, with a pole across the top. A lid on top of the drum was made fairly large (it should be made as large as possible).

The drum works end over end like a churn and the sand falls from top to bottom every half turn. The drum is charged with a full petrol-tin of sharp river sand and three petrol tins of water. Half a bag of nuts is emptied into this charge and turned one hundred times in 1½ minutes approximately.

The nuts, which float, are scooped out into a hand sieve and the contents and sieve are then immersed a few times in clean water. After washing in water the nuts are emptied out on to frames of ½in. mesh netting which should be at least 12in. from the ground to allow a good circulation of air underneath to dry them out. The nuts are left to dry in the open, exposed to the sun, for 24 hours. One roll of netting provides four frames, each 12½ yards long.

For washing the nuts in clean water after they are taken from the drum, I used half a 400-gallon galvanised iron tank and made the sieves to fit comfortably inside this. Two natives hold the sieve and work it up and down in the water two or three times.

The water in the drum requires to be changed with every five bags of nuts washed, or with less, depending on the amount of soil adhering to the nuts, and the water in the tank should be changed when it becomes obviously discoloured. The water from the tank is again used in the drum with sand for the next lot of nuts to be treated.

Three natives treated 20 bags daily, but I am quite sure with, say, six natives—allocated as follows—one could treat 30 to 40 bags daily: two natives to the drum, two to the sieve and two carting water, bagging, weighing and sewing the bags.

The product of a farmer in my district who used my drum was perfect, and in all my experience I have not seen cleaner nuts.

ASPARAGUS STORAGE.

GERMAN EXPERIMENTS.

An interesting and instructive report on German experiments in packing and storing fresh asparagus has recently been drawn up by an American Trade Commissioner in Berlin and published in the official journal of the U.S.A. Bureau of Foreign and Domestic Commerce, Washington. It is emphasised that asparagus is a highly perishable vegetable, and that the season for its consumption in the fresh state is very short—from six to eight weeks. Prices are naturally highest at the beginning of the season, and drop as arrivals increase towards the high point of the season.

The experiments relating to the keeping of asparagus in cold storage have been made with the object of lengthening the season during which fresh asparagus is available and maintaining prices at more or less stable levels. The temperature of the cold storage chambers, states the report, was held at from 32 degrees F. to 33.8 degrees F. with a relative humidity of 90 per cent. Under 32 degrees F. it was found that considerable damage was caused by frost and that each degree over 32 degrees F. increased materially the chances for mould to develop because the relative humidity had to be kept at such a high point. Therefore, the most important experiments were carried on with a temperature from 32 degrees F. to 33.8 degrees F. all with a relative humidity of 90 per cent.

In order to minimise the damage of mould, it was necessary to pre-cool the fresh asparagus very quickly after it was cut and eliminate as much as possible all transportation, cutting and packing. The asparagus must be placed in storage not later than 24 hours after it is cut, and it must be sound and without bruises. Before the rooms are filled with asparagus they are thoroughly disinfected by shooting

oxone through them. The packing material also must be as sterile as possible in order to keep bacteria growth at a minimum. The experiments showed that, generally, asparagus having a blue shimmer to the tip and shot a trifle more than the average softened much quicker in storage than the heads which were absolutely white and were dug underground.

The asparagus stalks were packed in various ways, namely, loose in sand, in peach mulch, in oil paper, and in glassine paper, as well as in parchment paper and in cork dust. The bundles were wrapped in half-kilos and one-kilo packages. Asparagus packed in weather-proof glassine paper showed the best results. Oil paper gave the next best results, but did not compare with glassine paper in that the vegetable did not keep so well and could not be seen while in storage. All other methods of packing proved of no value.

The general results of the experiments are summarised in the report as follows: The fresh asparagus of good quality packed in glassine paper and stored in a chamber with a 90 per cent. moisture content and a temperature from 32 degrees to 33.8 degrees F. kept very well from five to seven weeks. After this, individual heads began to get soft and it was firmly established that the maximum time the vegetables could be kept in storage is eight weeks. There was no difference between the asparagus that was washed before being placed in storage and that which was unwashed.

Experiments made in cooking showed that there was absolutely no difference in the taste of the vegetable after its six to eight weeks' storage. The report concludes by pointing out that the storage costs incurred were well worth while, because of the higher prices obtained for stored asparagus after the height of the season was passed. ("Ice and Cold Storage," October, 1932.)

FARMING CALENDAR.

December.

BEE-KEEPING.

With a normal season the first or main honey-flow of the year should now be over and the honey ready to be robbed. Before doing this, see that all or the main portion of the frames are capped and sealed, otherwise there will be trouble later on by fermentation. There is nothing on the market to equal the Porter bee-escape board to clear out the bees from the crate, but be sure and see that the board in question is placed the right side up under the crate; failure to do this (and in the hurry of the minute it can easily be so done) will result in the probable suffocation of the bees and the loss of the honey, to say nothing of the chances of robbing from any close-by hives. Replace the empty combs and frames as soon as possible on the hives, to be cleaned up and mended where necessary, and for future storage of more honey. During the very hot spells watch the hives and provide extra ventilation, by inserting small metal wedges between the crates, just wide enough to allow air in, but not a bee under any consideration. Keep all water tins under the hive-stand legs full of water, and see that water is available for the worker bee, which drinks a good deal. When extracting honey, do so in a bee-tight room or verandah, otherwise the operator may have a lot of trouble from other colonies, which quickly find where honey is. Always have one or more crates of shallow frames ready with foundation fixed to place on hives as the season may warrant; such will mean always something for the bees to work at, and during the last flow they may be invaluable to store any such catch crop of nectar, as from tobacco, etc., when the natural flora is finished.

CITRUS FRUITS.

This is a good month to plant citrus trees into their permanent positions. They should on no account be planted deeper than they stood in the nursery. Water each tree immediately after planting it to settle the soil, then loosen the surface when sufficiently dry to check weed growth and restrict evaporation; continue loosening the surface soil after each rain or watering. If good rains have fallen, disc the grove in two directions, then sow the cover crop and harrow also in two directions. If the grove is weedy it should receive a shallow ploughing in place of the discing. Then sow the seed and harrow the soil. All bearing trees must be kept well watered if the weather continues to remain dry. Trees that suffer for want of moisture while the young fruit crop is developing will be adversely affected, and the crop—if any—will be of inferior quality. Continue to rub off all water shoots or suckers which develop on the tree stems.

CROPS.

Keep the cultivators going, both on planted and unplanted lands, whenever weather conditions are favourable. Destroy the weeds while young and before they obtain a firm root-hold.

Continue planting maize, cotton, beans and ground-nuts as early as possible this month, followed by sunflowers, Sudan grass, manna, pumpkins and cattle melons. Linseed, cowpeas, teff grass, oats, Sunn hemp should be planted after the other crops are in. Ensilage crops may be

sown at the end of the month. When harrowing maize after planting, this work should be done in the heat of the day when the young plants are flaccid and not easily broken. On lands not yet planted the crop of weeds should be kept down by disc-harrowing. It is a good plan to harrow or disc-harrow immediately before the planter, or alternatively to follow the planter with a light harrow. Treat seed oats for smut before sowing. Use one pint of formalin to 25 gallons of water and steep the bag of seed for ten minutes. Earth up early planted potatoes. Keep a look out for the stalk-borer, and top or otherwise treat affected plants. New lands and old pastures may be broken, as circumstances permit, during December, January and early February, and again ploughed in from May to July. If they carry a heavy crop of grass it should be cut or burnt to enable good, clean ploughing to be done. Sweet potato slips should be planted early in this month. Do not fail to have in a few acres of this valuable crop.

DECIDUOUS FRUITS.

Cover crops may be planted when the rains commence, as recommended under citrus fruits. Summer pruning may be commenced this month. If all undesirable shoots are taken out of the trees, the remaining shoots will receive sufficient air and light to mature. Ripening fruit must be carefully harvested, graded and packed if satisfactory prices are to be secured. Do not gather any fruit when it is wet. Keep all recently planted trees in good condition; the first year's growth is the most important. If the undesired shoots are rubbed off when they first appear, the retained shoots will receive all the nourishment and the tree will then grow to a large size.

ENTOMOLOGICAL.

Maize.—The first half of this month appears to be the best period during which to plant maize for the avoidance of stalk borer attack—at least in the Salisbury district. Hoe out and remove volunteer maize plants before the new crop is up, as they are liable to be infested with borer, which tends to spread to surrounding plants. Red soils may be baited with chopped Napier fodder or other suitable greenstuff dipped in arsenite of soda 1 lb., cheapest sugar 8 lbs. or molasses 1 gallon, water 10 gallons, to destroy surface beetles, snout beetles and other insects which may affect the primary stand.

Tobacco.—The enemies of this crop are in general most active during December, whilst the crop is still in the early stages of growth.

For information regarding tobacco pests, see "Rhodesia Agricultural Journal," January, 1928, or Bulletin No. 665.

In general, poisoned baits may be used against surface beetles, grasshoppers, crickets and cutworms. Against surface beetles, arsenite of soda 1 lb. in 30 gallons of water used to moisten maize bran is a good bait. Against grasshoppers and crickets the addition of 8 lbs. sugar or 1 gallon molasses to each 1 lb. of arsenite of soda is recommended. Spray with arsenate of lead (powder) 1 lb. in 30 gallons of water against leaf-eating insects and as a protection against leaf miners and stem borer. Transplants may be dipped head downwards as far as the roots in the poison. Discard seedlings infested with stem borer and root gallworm.

Cutworms.—Keep ground around seed beds as free as possible from vegetation, to prevent female moths from laying eggs there. From the time the plants show foliage of the size of a sixpence they should be sprayed weekly with arsenate of lead (powder). 1 lb. to 30 gallons of water. This should prevent cutworms developing in the beds, as the young cutworms attack the leaves of the seedlings, and so ingest the poison.

House Flies.—With the coming of hot weather and the rains, house flies greatly increase, and should be kept out of dwelling houses by mosquito netting, or poisoned in the following way:—Dissolve 1 lb. of sodium arsenite in 10 gallons of water, and add about 10 lbs. of cheap sugar (2 gallons of treacle) or other sweet substance. The mixture should be sprayed

upon branches of shrubs or trees, which may be hung up in convenient places where flies congregate. These insects are attracted to the bait, and are easily poisoned.

Mosquitoes, Stable Flies.—Destroy breeding places around homestead. Poison or trap adults.

Potatoes.—Ladybirds and caterpillars may be injurious to the foliage, and on sandy soils blue blister beetles sometimes cause damage. Spray with arsenate of lead (powder) 1 lb. to 25 gallons of water.

Kitchen Garden.—Marrows, etc., are commonly attacked by leaf-eating beetles. Spray with arsenate of lead (powder) 1 lb. in 25 gallons water, plus 8 lbs. cheapest sugar or 1 gallon molasses. Dusting lightly with pure arsenate of lead powder should give protection. Young plants of the cabbage family may be dusted with pure arsenate of lead powder or with such powder mixed with up to six or eight parts of finely sifted, thoroughly slaked lime as a protection against leaf-eating insects.

Fruit Trees.—The regular collection and destruction of fruit beetles may be necessary. Choice varieties of peaches, etc., may be netted as a protection against pests.

FLOWER GARDEN.

This month is generally showery, and constant stirring of the soil is, therefore, necessary to keep it loose. Seeds of perennials and annuals for February blooms may be sown. Transplanting should be done in the evening or on a cloudy day. Carnations should be kept free from dead wood, and climbers attended to.

VEGETABLE GARDEN.

All vegetable seeds may be planted. All advanced plants should be constantly cultivated. Potatoes should be ridged, and peas, beans and tomatoes staked. This is a good month for planting the main crop of potatoes.

FORESTRY.

Final preparations for planting should be made, including harrowing or pitting. Early plantings may be carried out if the season is a good one. Planting should be carried out on dull, rainy days, or failing such days, late in the afternoons. Great care should be exercised in planting out to avoid bending the tap root, and to set the trees in the ground at the same level as they were in the seed bed or tray. Late sowings of Cedrela toona seed may be made.

POULTRY.

The poultry keeper should take precautions whereby the wet weather will not affect his birds' health and their laying powers. All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs. Foodstuffs also must be kept absolutely dry.

Many birds will at present be moulting; these require special treatment to bring them through it quickly, and if possible keep them in lay during the period. A pamphlet on this can be obtained from the Poultry Expert, Department of Agriculture. This lack of attention to the birds during the moult is one of the causes of the scarcity of eggs at this season. There is no need for it if poultry keepers would only look after their birds properly.

Those who intend disposing of their turkeys for killing at Christmas must avoid cooping them up, as is done when fattening fowls, for they immediately mope and go off their food. Give them free range, and in addition to their usual evening feed of maize, during the first week of December give one of wheat or maize in the morning, and during the second and third weeks three meals a day, each one containing, in addition

to wheat or maize, some crushed monkey nuts or sunflower seeds. Plenty of thick milk and chopped-up onions or onion tops should also be given.

Those who go in for ducks should feed well and get as many to marketable size as possible by Christmas, when they usually fetch good prices. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, maize meal, meat meal and milk, as much as they will eat three times a day, i.e., they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 p.m., and the first meal is given at sunrise.

STOCK.

Cattle.—Feeding should be continued on the same lines as in November. Keep a close eye on any store bullocks that have been selected for fattening on grass.

Ranching cattle should not require any attention beyond dipping. Every effort should be made to have all the female stock in good condition for the breeding season.

Milch cows should be protected as much as possible from cold rains and hot sun. Yarding at night in a clean kraal provided with a simple lean-to shed well bedded up will be found to be very beneficial in seasons of protracted rainfall. The calf-pen should be kept clean, dry and sweet, and young calves will be better kept in during very hot or very wet weather.

Sheep.—Graze on the higher lands, keeping the kraals clean, dry and airy, and watch for ticks. Take out the rams at the end of the month.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

TOBACCO.

Continue preparation of land. The best results are obtained by transplanting on well prepared soil. Transplanting should be pushed on with as fast as transplants and climatic conditions will allow. As soon as plants begin to grow, go over the field and fill in all missing hills with strong selected plants, and then apply fertiliser to hasten growth and ensure early maturity. Cultivation should be commenced as soon as the plants start growing, especially on sandy soils. The crust caused by heavy rains should be pulverised through cultivation as soon as the surface soil is dry enough for tillage; this gives the young plants the benefit of the moisture stored in the soil. Do not neglect the late sown seed beds. Make every effort to finish transplanting before the end of the month, so that the crop will be harvested before dry, cool weather begins.

VETERINARY.

Occasional cases of horse-sickness may occur during this month. With the great increase in ticks, due to the heat and moisture, cases of redwater and gall-sickness may be expected, more especially amongst Colonial stock imported since the last rainy season. The cool weather which frequently follows the early rains is an excellent time for castrating calves and other animals.

WEATHER.

In Mashonaland the rainfall during this month varies from eight inches along the eastern border to six inches in the west. In Matabeleland it varies from five-and-a-half inches in the west to four-and-a-half inches in the south. Considerable divergencies from these normals may occur in individual seasons, but on the whole this month is the most regular in its behaviour. Very heavy downpours may be looked for, and it is well to be provided by drains and ditches against the effects of very heavy rain storms. A dry spell about Christmas time is a very frequent, though not invariable, event in Rhodesia. This partial drought may last only a fortnight, or may extend to six weeks, in the latter event often causing some anxiety regarding young crops, especially those not yet through the ground. The best means of meeting this condition of the weather is by frequent surface cultivation by harrow or horse hoe to preserve a loose soil mulch on the surface and prevent losses of soil moisture by evaporation.

January.

BEE-KEEPING.

This month is a slack one for actual hive work. Each hive should continue to be carefully watched to see that any attempt by the wax moth to gain a footing is at once stopped. In the great heat of this month, see that proper ventilation is supplied, as well as enough water. Precautions against the depredations of white and other ants should also be watched daily. Where possible, examine now and again the brood chamber for queen cells, and destroy them if not wanted. Requeening can be done where desired on the uniting system, if the apiarist does not know of the better plan of rearing his own queens. In the workshop have a spare hive

or two complete and ready for occupation, well painted, for any new swarms that may be required in the coming months. Though the second honey flow of the season is not due to start until about March or April, there should be ample stores coming in meanwhile to keep all bees busy in breeding, nursing, and bringing the hive generally to full strength for the winter, as well as for their own daily food supplies. There will not be enough honey coming in now for surplus purposes, therefore see that the supers are not left on the hives to a greater degree than to give the inmates plenty of room to loaf in.

CITRUS FRUITS.

The planting of citrus trees should be completed if possible by the end of the month, for trees planted later may not harden up before the winter; they then become susceptible to winter injury from cold. This month is the best one for planting shelter belts to protect all varieties of fruit trees from the prevailing dry winds. Cover or green crops may be planted during this month; if the grove has been over-run with grass or weeds, sow the cover crop seed more thickly. This will assist in smothering future weed growth. Continue suppressing any undesirable shoots that may develop on the tree trunk or other parts of the tree. Drain any depressions that allow rain or irrigation water to accumulate at the base of the trees, for trees permitted to stand in water will speedily fall victims to disease or pest injury.

DECIDUOUS FRUITS.

Continue planting cover or green crops between the trees. These crops may then be turned under towards the end of the rainy season to furnish the necessary humus.

Summer pruning may be continued. Rub or break off any undesirable shoots that have a tendency to crowd each other; suppress all growths on the main stem from the ground level up to the main arms of the tree, for these are unnecessary. If next year's fruit crop is to be of good size and quality, the inner fruiting wood of a tree must receive sufficient air and light to mature fully. If the new growth is too dense it will prevent the fruiting wood from maturing, and poor crops will be the result. The thinning out of the summer growth will overcome this crowding and weakening of the fruiting wood.

Many fruits will be ripening during the month. Do not permit the fruit to become over-ripe on the trees; rather harvest it at the correct stage and store or sell the surplus.

Plant shelter trees if the orchard is exposed to the prevailing winds, as good crops of fruit cannot be expected from inadequately protected fruit trees.

CROPS.

If not already sown, put in the ensilage and fodder crops at once, such as maize and legumes, oats and other hay grass crops. Sow short season crops like haricot beans, linseed, buckwheat, peas, summer oats, gram and mung bean. Plant out grasses and kudzu vine for pasture. Ridge potatoes and cultivate thoroughly. Main crop can still be planted. Quick growing green manuring crops, such as cowpeas, soya beans and sunn hemp, may still be sown this month. Earth up ground nuts so that a small amount of loose soil is thrown over the crowns of the plants. This assists the formation of nuts. If not already done and where practised, legumes or long season oats such as Algerian can be sown under the maize crop for grazing and to add nitrogen and humus to the soil. Cultivate all growing crops well, and thoroughly eradicate weeds. Overhaul all hay-making implements and ploughs and get in thorough repair in preparation for the haying and ploughing seasons. Endeavour to mow grass fields early for hay and litter, and to obtain second cutting for hay in April. Fallowed lands or fields not yet planted may be disc-harrowed or ploughed to prevent weeds from seeding. Mow grass paddocks

infested with annual weeds to prevent the weeds seeding. Prevent Mexican marigold and other noxious weeds seeding by hoeing or pulling out the plants by hand. Keep a sharp look-out for maize stalk borer. Cut off the tops of infested plants or treat them with a recognised chemical preparation. If topping is practised, remove tops from land, and bury, burn or feed them at once to farm stock. Watch the maize lands for witch weed. Prevent witch weed plants from seeding by cultivation and by hand-pulling the plants. Make as much manure as possible by placing grass and litter in cattle kraals, pig sties and stables. If there is stumping and clearing to be done, push on with it. Endeavour to get as much of the new virgin land as possible broken up during this and the two following months.

ENTOMOLOGICAL.

Maize.—Late planted maize, particularly crops planted after the New Year, are frequently attacked by the maize stalk borer (*B. fusca*, Full.) in districts where this pest is prevalent. The yield of grain from heavily attacked stands is usually very low, and such crops are most economically used as ensilage. Plants attacked are easily detected in the fields, as the newly hatched caterpillars eat the young leaves before entering the stalk. Top dressing with a suitable insecticide should be employed to ensure a good yield. There are several insecticides which can be used for top dressing which kill the young caterpillars without causing severe injury to the plant. Kerol, Kymac or Hycol used at a dilution of 1 in 300, or Pulvex, 1 in 54 gallons of water, give satisfactory results. A new preparation, Derrisol, is highly recommended by the manufacturers at 1 in 1,000, and is stated to be quite innocuous to the plants. The liquid should be poured into the funnel-shaped cup formed by the young leaves. Only those plants showing attack are usually treated. With a light infestation, one native can treat about five acres per day. Several treatments may be necessary. Young maize plants up to six weeks old can be treated by cutting the plant below the point attacked. The portions cut off must be removed from the lands.

Various leaf-eating insects (including the snout beetle (*Tanymicus destructor*), the surface beetles, grasshoppers, etc.) attack young late-planted maize.

The attack by the snout beetle may be very severe. If there is time, it is often advisable to harrow in the old crop, treat the land with poison bait and re-plant, or poison bait may be used without removing the crop. The best carrier for poison bait is chopped Napier fodder or some other green succulent grass, including maize itself; failing this, maize or wheat bran may be used. The carrier is thoroughly covered or impregnated with a solution of arsenite of soda 1 lb., molasses 1½ gallons, or cheapest sugar 8 lbs., water 10 gallons, and broadcast. The cheapest arsenite of soda to employ is locust poison, diluted 1 in 200, and equivalent quantity of sweetening agent added. The best results are obtained if the broadcasting is done in the evening, as the hot sun dries up the bait too quickly and renders it unattractive to the beetles.

Army Worm (*Laphygma exempta*) may put in an appearance during the latter half of December, and a sharp look-out should be kept for the caterpillars, especially on sweet grasses near the maize lands and on "rapoko grass" (*Eleusine indica*) on the lands. (See *Rhodesia Agricultural Journal*, October, 1930, page 1055.)

Black Maize Beetle.—Both larvæ and adults of this beetle are active during this month. Hand collecting of the adults is the only practical procedure. For further control measures, see *Rhodesia Agricultural Journal*, February and April, 1925.

Potatoes.—This crop, if attacked by leaf-eating ladybirds, blister beetles or other leaf-eating insects, may be sprayed with arsenate of lead (powder), at the rate of 1 lb. in 25 gallons of water. This poison may be combined with Bordeaux Mixture when spraying against early blight.

To protect potatoes from potato tuber moth, the rows should be ridged deeply and the tubers kept covered with soil.

Tobacco.—Tobacco in the field is attacked by many insects during this month, and growers should keep a copy of Bulletin No. 665, "Tobacco Pests of Rhodesia," handy for reference, or refer to *Rhodesia Agricultural Journal* for January, 1928. The following very brief account of the more common insect pests attacking this crop may help the grower who cannot consult the above-mentioned bulletin.

Cutworms.—Keep all lands free from weeds up to the time of planting out.

Stem Borer.—All seedlings showing the characteristic swelling should be destroyed by fire. Plants in the field should be destroyed and replaced, or the plant may be cut off below the swelling and one sucker encouraged to grow. The latter procedure needs to be carried out early.

Leaf Miner.—All primings should be destroyed, and infected leaves may be picked off.

Seed Beds.—Seed beds which are no longer required should be cleaned up and not allowed to become a breeding ground to infest the fields. Beds in use should be kept properly covered with limbo and sprayed weekly with arsenate of lead, 1 lb. in 30 gallons of water.

Wire Worms (Trachynotus spp.).—Several species of wire worms attack this crop during January, particularly on sandy soils. It is now too late to attempt control. Control depends upon the accurate timing of the emergence of the adult beetle and poisoning with a poison bait. Emergence usually takes place late in April or in early May. The bait consists of maize meal or bran poisoned with arsenite of soda (locust poison, 1-200). The bait is made up into balls, scattered about the lands. The balls should be covered with leaves, to give attractive shade and to assist in keeping the bait moist. Moisture should be added when necessary.

Surface Beetles (*Zophoses* spp., *Gonocephalum* sp.).—The same control measures apply as for wire worm. Baits recommended against wire worm can be applied during January. No sweetening matter is necessary.

Bud Worm (*Heliothis obsoleta*).—Destroy all caterpillars by hand during "topping." Examine all bagged seed heads weekly and destroy any caterpillars discovered.

Other Leaf-Eating Caterpillars.—A bad attack in the field may be controlled by spraying with arsenate of lead (powder), 1 lb. to 30 gallons of water. A knapsack spray pump with a cyclone nozzle is necessary. Hand picking may be employed.

Beans, Cowpeas, etc.—Haricot beans and cowpeas are liable to attack by the stem maggot (*Agromyza* sp.). This small fly deposits its eggs in the young leaves, often within a few days of germination. The larvæ mine along the veins and down the stem, pupating about soil level. Practically nothing can be done to protect a field crop. Velvet beans, Jack beans and dolichos beans are not attacked by this pest.

All varieties of beans are attacked by a leaf-eating beetle (*Ootheca mutablis*). This small insect can be controlled by spraying with arsenate of lead (powder), 1 oz. to 3 gallons of water.

Blister beetles are often very numerous on the flowers of all species of beans and cowpeas. Hand collecting has been found to be the most economical measure.

The bean stem weevil is a minor pest of beans in the kitchen garden. All plants attacked by this weevil should be picked out and burnt.

Sweet Potatoes.—Sweet potatoes may be attacked by caterpillars of the sweet potato sphinx moth. These should be collected by hand.

Kitchen Garden.—Marrow and cucumber plants about to set fruit may be sprinkled regularly with the following formula to destroy fruit flies

which "sting" fruit:—Arsenate of lead (powder), $1\frac{1}{2}$ ozs.; molasses, $\frac{1}{2}$ gallon, or cheapest sugar, $2\frac{1}{2}$ lbs.; water, 4 gallons. To destroy leaf-eating insects generally, dust plants with arsenate of lead (powder), 1 part in 20 parts of finely-ground maize meal or finely-sifted slaked lime. *Aphides* (plant lice) may be treated with soap, 1 lb. in 5 gallons of water, or tobacco wash, or simply by regular spraying with a forceful stream of cold water from a spray pump.

Fruit Trees.—Deciduous fruits are subject to attack by large beetles, which should be destroyed by jarring into a net and dropping thence into a tin containing water, with a film of paraffin on the surface. Trees should be covered in mosquito netting to protect the fruit from fruit-piercing moths. The large adult beetles of the fig borer may be seen on the young shoots and should be destroyed. Borers in the trunks of the trees may be killed by injecting a little carbon bisulphide.

Mosquito, House Flies, etc.—Screen windows and doors. Destroy breeding places around homestead. House flies may be poisoned cheaply with sweetened arsenite of soda solution. Write for directions.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

This month requires all one's energy in the flower garden. Annuals may still be sown for late flowering before the season is over. Planting out should be done as early as the weather permits, and advantage taken of a dull day after a shower for this work. If care be exercised much smaller plants may be put out than would at first be thought advisable, as with attention these will make stronger plants than larger ones, which are more likely to receive a check. The soil requires constant stirring, owing to the packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free of dead and decaying matter.

VEGETABLE GARDEN.

Turnips, carrots, cabbages, lettuce, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on.

FORESTRY.

If the rains are seasonable, plant out evergreen trees, such as gums, cypress, pines, etc. Fill in all blanks as soon as they are noticed, and do not leave them until the following season. Planting should be done on a wet day, or, failing that, on a dull day, or late in the afternoon. Great care should be taken to see that the trees are not planted out any deeper than they stood in the tins.

POULTRY.

All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs.

Foodstuffs must be kept absolutely dry, otherwise they will become mouldy and sour, causing disturbance of the intestinal tract, illness, and perhaps death; certainly a diminution in the number of eggs.

Some of the birds will now be in moult. To get them through it quickly give more sunflower seed, some monkey nuts, plenty of green food, especially cabbage, kale, etc., plenty of milk or some meat, a little sulphur

in the dry mash (one teaspoonful to 1 lb.) ; also stew two dessert spoonfuls of linseed in a pint of water to a jelly, mix this to a crumbly consistency with mealie meal or bran, and give about one dessert spoonful to each bird daily. Keep the birds dry during the rains, otherwise the egg output will decrease.

Do not hatch any more turkeys till after the rainy season is over. Turkeys should not be penned up, but allowed on free range.

Ducks must be treated in almost exactly the reverse manner to what turkeys are. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, mealie meal, meat meal and milk, as much as they will eat three times a day, *i.e.*, they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 p.m., and the first meal is given at sunrise.

STOCK.

Cattle.—Put the bulls into the herd now to secure spring calves. The bulls should be in good condition at the commencement of the service season and their condition should be maintained while they are working. This season calves should be looking well by this time and care must be taken not to over-milk the cows in consequence. Cows rearing calves should not be milked more than once a day. Hand-reared calves should be kept in dry, clean quarters. In the warmer weather they often do better if they are kept indoors until they are three or four months of age. Bullocks which are being fattened on grass should receive a concentrate ration from now onwards. During this month a protein concentrate should usually be added to the milch cows' ration.

Sheep.—Keep the sleeping quarters as dry as possible. Keep the sheep away from vleis and "rotate" the grazing as much as possible. Sheep are liable to suffer severely from internal parasites from now onwards.

DAIRYING.

(See December.)

TOBACCO.

Cultivation should be systematically continued, and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attacks. All backward plants should be given special attention, and an additional application of fertiliser to hasten growth, so that the plants ripen as uniformly as possible. Curing barns should be placed in proper condition on rainy days, and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform and disease-free plants for producing seed for next season's crop. All plants should be properly primed at the same time that the tobacco is topped.

VETERINARY.

Horse sickness may now be expected, especially in districts where early heavy rains have occurred. Blue tongue in sheep will also be prevalent.

WEATHER.

Heavy rain is to be looked for, and during this month we may normally expect nine to twelve inches on the eastern border, eight in the north, and seven to seven and a half as one travels westwards or southwards. At this time of the year the rainfall tends to be heavier in the eastern than in the western portions of the Colony, whilst prolonged steady rains take the place of the thunder showers which marked the earlier part of the wet season. The growing period is at its height, and high temperatures are registered.

SOUTHERN RHODESIA VETERINARY REPORT.

September, 1932.

AFRICAN COAST FEVER.

Rocklands Estate.—Fifteen head of stray cattle were rounded up and isolated near Rocklands homestead. One case of coast fever occurred and the remainder were slaughtered.

Glencoe.—Two cases of coast fever occurred on this farm. The herd involved was moved to a temperature camp on the adjoining farm, Hayfield.

FOOT AND MOUTH DISEASE.

Insiza District.

No fresh outbreaks. In the Siwazi and Mbondu dipping tank areas all the cattle concentrated for inoculation had been returned to their respective kraals by the 17th September.

Gwanda District.

A fresh outbreak occurred on the farm Timber adjoining the previously infected farm Deneys. Infection was carried by four bulls, which strayed from Deneys. A cattle-free belt was established around Timber and Deneys by removing all cattle from adjoining farms except on the eastern side, where the cattle are immune. Most of the cattle so removed were concentrated on Timber and Deneys and inoculated. It is hoped that these arrangements will confine the disease to Deneys and Timber.

On Railway Block No. 2 all the inoculated herds had recovered completely.

Gwelo District.

No fresh outbreaks. The herds inoculated during August in the Sonambula section reacted satisfactorily, except in one herd of 75 head in which active infection was found four weeks later. It is difficult to account for the delayed reactions in this case as the same virus used on the other herds on the same day gave satisfactory reactions.

In the eastern section of the district a fresh outbreak occurred on Gold Fields South (Rhodesdale), east of the Bembezaan River. All the herds involved and in contact were concentrated and inoculated.

ANTHRAX.

An outbreak occurred amongst cattle in the Bromley section of the Salisbury district. All in contact animals were vaccinated.

IMPORTATIONS.

From the Union of South Africa and the Bechuanaland Protectorate: Cows and calves 10, heifers 4, bulls 7, horses 9, mules 1, sheep 1,458, goats 115.

EXPORTATIONS.

June: 41 carcases beef to Great Britain.

August: 40 carcases beef to Great Britain.

J. M. Sinclair,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA WEATHER BUREAU.

OCTOBER, 1932.

Pressure: The mean barometric pressure varied from 1 to 2 millibars above normal.

Lows were active on the south coast from the 1st to the 4th. A high appeared on the west coast on the 4th and moved up the east coast on the 5th, causing strong S.E. winds and some drizzle. Pressure changes were slight until the 14th, when a deep low approached the south coast; it remained and deepened during the 15th and 16th and then disappeared. The succeeding high was late and only approached on the 18th. A low on the south coast on the 18th and 19th left the equatorial low, extending into the Union on the 20th. The succeeding high on the 22nd had little effect. A deep low on the south coast on the 24th and 25th was followed by a weak high, which moved up the east coast on the 26th. A second high appeared on the south coast on the 28th and deepened and approached on the 29th. Strong south-east winds and some rain were experienced on the 29th and 30th.

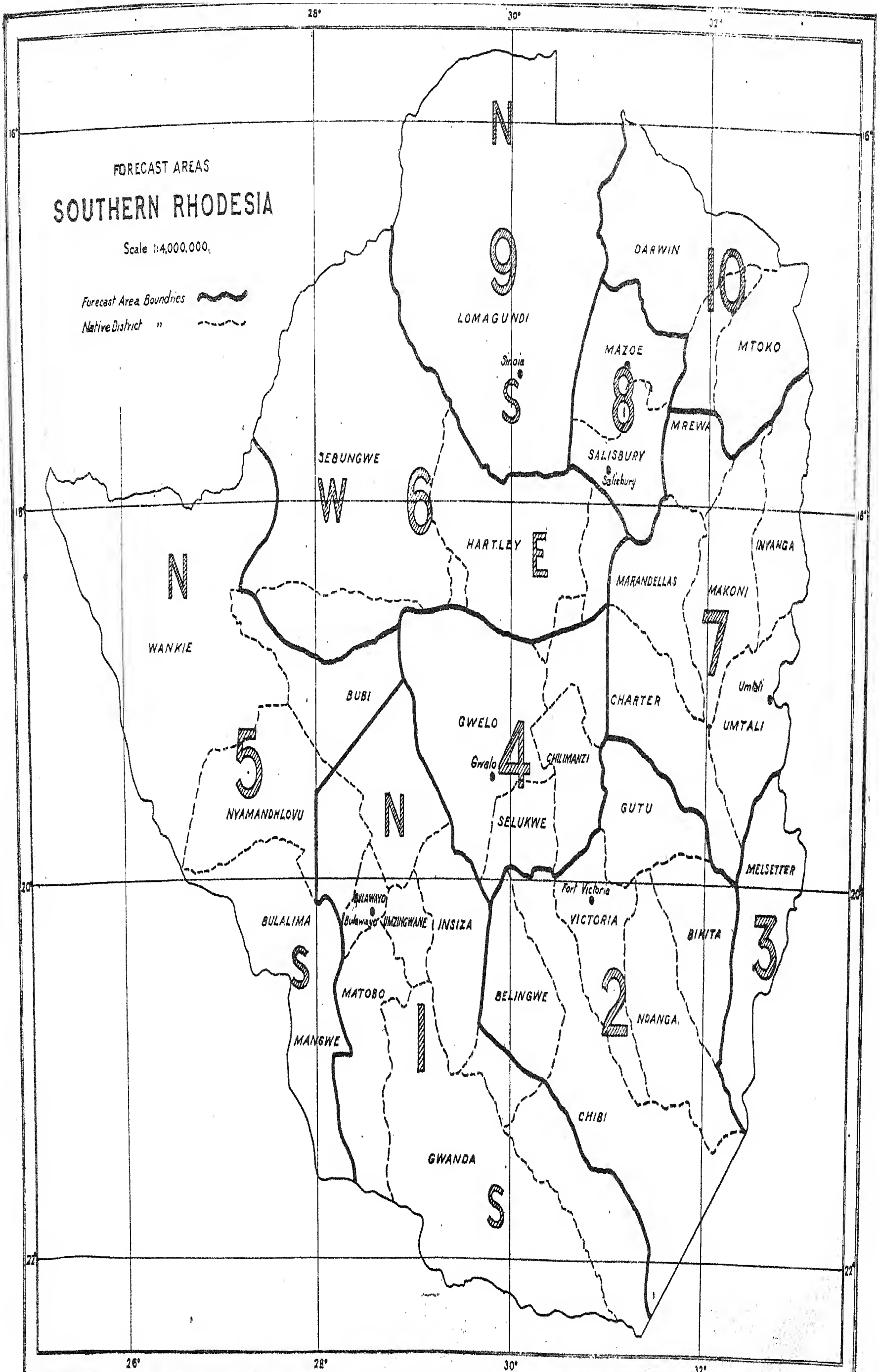
Temperature.—Mean minimum temperatures were generally about normal but maximum temperatures, particularly in the Midlands, were well below normal.

Rainfall.—Very light rains occurred in a few areas and the average over the country only amounted to 0.2 inches.

Rain Records.—A summary of the daily rainfall telegraphed from 57 stations is shown grouped in the forecast areas, indicated in the accompanying map.

OCTOBER, 1932.

Station.	Pressure Millibars, 8.30 a.m. Mean.	Normal.	Temperature in Stevenson Screen ° F. Absolute. Max.	Absolute. Min.	Mean. Max.	Mean. Min.	Mean. ½ Max. Min.	Mean. Normal.	Mean. Dry Bulb.	Mean. Wet Bulb.	Rel. Hum. %	Dew Point F.	Cloud Amt. 0-10	Precipitation. Ins.	Precipitation. Normal.	Precipitation. No. of Days.	Altitude (Feet).
Bulawayo ...	...	869.1	...	...	...	...	...	72.3	...	...	...	...	...	...	0.9	...	4,436
Gwelo	864.5	...	93	47	84.8	57.1	71.0	72.5	70.0	58.6	50	50	2.7	...	0.7	...	4,632
Riverbank ...	...	...	100	49	90.6	61.2	75.9	76.0	73.1	59.3	43	49	...	0.24	0.7	2	4,100
Essexvale ...	...	...	101	45	91.3	58.6	75.0	74.2	71.2	60.5	53	53	...	0.18	0.8	2	3,828
Gwanda ...	908.2	...	99	45	86.2	61.4	73.8	...	73.3	60.0	45	51	2.5	0.61	0.9	2	3,235
Mazunga ...	950.4	949.3	104	45	90.4	60.8	75.6	77.3	75.0	63.3	52	57	4.5	0.67	1.0	2	1,970
Nuanetsi ...	...	...	103	48	90.5	61.0	75.8	...	72.3	64.6	66	61	3.9	0.73	0.9	3	1,630
Between Rivers	...	...	97	46	89.6	59.1	74.4	...	75.2	59.9	40	49	1.1	0.39	1.4	3	3,970
Enkeldoorn ...	859.4	...	91	48	83.4	56.0	69.7	71.3	71.2	58.2	45	48	1.1	...	1.3	...	4,720
Gatooma ...	...	...	97	49	90.6	58.8	74.7	76.2	73.3	60.1	45	51	1.0	0.01	1.1	1	3,850
Miami	879.8	...	93	52	86.2	60.6	73.4	...	74.7	60.2	42	50	0.8	0.58	0.2	3	4,090
Salisbury ...	856.6	855.7	91	50	83.8	57.9	70.9	71.0	71.0	57.1	41	47	1.8	0.03	1.3	1	4,890
Sinoia ...	889.2	...	98	51	90.0	58.8	74.4	...	77.0	60.9	38	50	0.6	0.32	1.2	3	3,804
Sipolilo... ...	...	...	93	55	85.5	64.5	75.0	...	74.0	59.7	42	49	0.9	0.07	0.7	1	3,900
Mtoko	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.8	...	4,210
Shamva ...	...	...	98	53	90.4	62.9	76.7	...	77.4	...	...	...	0.5	0.02	0.5	1	3,170
Angus Ranch ...	...	...	100	55	89.6	64.1	76.9	...	75.8	64.3	53	58	...	0.57	0.9	1	2,300
Craigendoran ...	...	...	102	50	91.4	59.5	75.5	...	76.6	63.4	48	55	...	0.13	1.7	1	3,410
New Year's Gift	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.2	...	2,700
Nyamasanga ...	...	...	90	47	82.3	55.0	68.7	...	71.9	58.2	42	47	...	...	...	...	5,680
Riverdene North	...	...	100	41	87.8	53.8	70.8	...	69.8	61.2	61	56	...	0.26	1.1	3	3,700
Stapleford ...	...	...	79	35	71.2	49.3	60.3	...	64.0	57.2	66	53	2.9	1.82	1.4	7	5,450
Umtali	895.2	894.4	90	49	82.5	58.2	70.4	70.9	70.2	60.3	56	54	3.1	0.58	1.2	3	3,677
Victoria ...	897.9	895.8	97	45	86.1	57.7	71.9	71.1	71.0	60.0	52	52	2.5	0.12	1.1	2	3,570
Melsetter ...	852.6	...	89	44	77.8	53.8	65.8	...	68.3	55.3	42	45	2.2	0.71	1.4	4	5,060
Mount Selinda	...	...	91	47	81.5	57.7	69.6	...	67.8	60.0	63	55	2.8	1.96	2.0	3	3,520
Manchester ...	...	...	81	41	73.2	52.8	63.0	...	56.3	53.4	83	52	...	1.41	...	3	...


FORECAST AREAS
SOUTHERN RHODESIA
Scale 1:4,000,000.
Forecast Area Boundries
Native District "
16°
18°
20°
22°
26°
28°
30°
32°
DARWIN
LOMAGUNDI
Sinoia
MTOKO
MAZOE
MREWA
SALISBURY
Salisbury
SEBUNGWE
HARTLEY
INYANGA
MARANDELLAS
MAKONI
WANKIE
BUBI
GWELO
Gwelo
CHILIMANZI
CHARTER
Umtali
UMTALI
NYAMANDHLOVU
SELUKWE
GUTU
MELSETTER
BULAWAYO
Bulawayo
UMZINGWANE
INSIZA
BULALIMA
Fort Victoria
VICTORIA
BIKITA
MATOBO
BELINGWE
NDANGA
MANGWE
CHIBI
GWANDA
N 9 S
N W 6 E
10
8
7
5
4
N
3
2
S 1 S
Irrigation Division
Department of Agriculture
Salisbury, 1931.

Rainfall, October, 1932, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
1	17	15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	1	...	...	355
2	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	...	...	...	...	...	...	1	32	...	...	41
3	...	...	...	...	15	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	9	...	...	...	...	...	...	1	77	...	...	103
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1	5	...	...	7
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	14	...	1	25
8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45	16	4	65
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	9	3	15	27
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mean	4	3	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1	10	1	2	23

DEPARTMENTAL BULLETINS.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.

No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.

No. 429. Propagation of Kudzu Vine, by H. C. Arnold.

No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.

No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.

No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.

No. 550. Onion Growing under Irrigation, by C. Mainwaring.

No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.

No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.

No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.

No. 630. The Storage of Seed Potatoes, by H. C. Arnold.

No. 634. Barley, by P. V. Samuels.

No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.

No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.

No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.

No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.

No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.

No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.

No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.

No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.
No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.
No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.
No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.
No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.
No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.
No. 759. Witch Weed (Striga Lutea): Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.
No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.
No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.
No. 781. Agricultural Costings at the Gwebi Farm—Maize and Green Manuring, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.
No. 787. Agricultural Costings at the Gwebi Farm—Ground Nuts and Maize and Beans for Silage, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 793. Agricultural Costings on the Gwebi Farm, by H. G. Mundy, Dip.Agric., Chief Agriculturist.
No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.
No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.
No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.
No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.
No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.
No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.
No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.
No. 833. Subterreanean Clover on the Sand Veld as Feed for Poultry in the Winter, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 836. The Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 837. Veld Grass Silage—A Feature in Rhodesian Pasture Management, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief, Division of Plant Industry.

No. 838. Witch Weed—Progress Report and a Warning, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

No. 841. Poisonous or Suspected Poisonous Plants of Southern Rhodesia: Tulp Poisoning of Cattle, by Sydney M. Stent, Senior Botanist, and D. A. Lawrence, B.V.Sc., Veterinary Research Officer.

No. 855. Pigeon-hole Method of Stacking Maize, by Division of Plant Industry.

No. 859. Twenty-one Years of Plant Introduction, by Major Mundy, Chief, Division of Plant Industry.

No. 867. Agricultural Statistics for the Season 1930-31: (a) Live Stock; (b) Crops Grown by Europeans in Southern Rhodesia, compiled by the Government Statistician.

REPORTS ON CROP EXPERIMENTS.

No. 608. Annual Report of Experiments, 1924-25, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.

No. 631. Bulawayo Experiment Station: Annual Report for Year 1925-26, by H. W. Hilliard.

No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

No. 675. Bulawayo Experiment Station—Annual Report for Year 1926-27, by D. E. McLoughlin.

No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.

No. 688. Report, 1923-24—1926-27, Gwelo Municipal Demonstration Stations, by D. E. McLoughlin.

No. 716. Report, 1927-28, Gwelo Municipality Demonstration Stations, by S. D. Timson, M.C., Dip.Agric.

No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.

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